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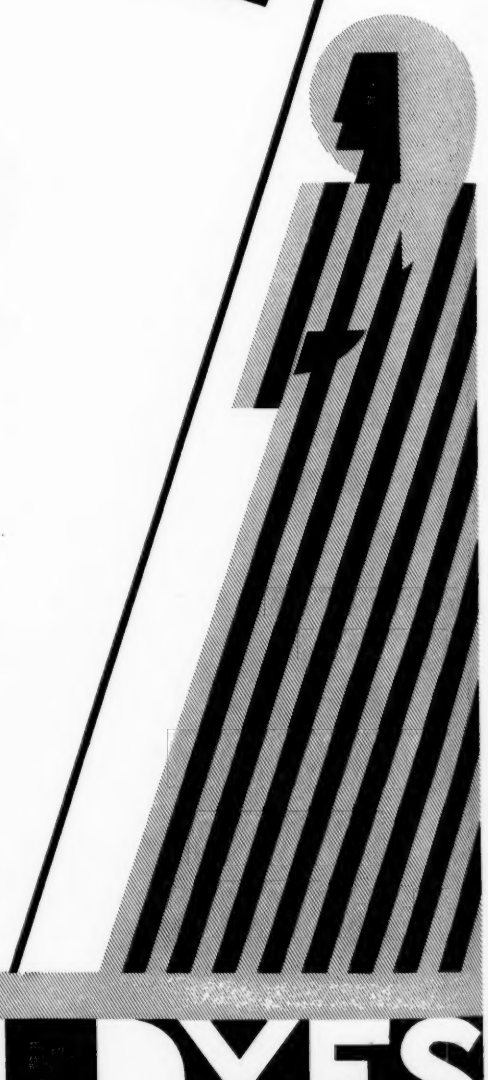

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The Weighting of Silk

By **WALTER M. SCOTT, Ph.D.**

Consulting Chemist with Gustavus J. Esselen, 73 Newberry St., Boston, Mass.

CHAPTER I. HISTORICAL

This article is a timely contribution to a subject which has assumed great importance in recent years. The first chapter gives an historical review of the development of silk weighting together with a bibliography of the patent literature on this subject. The second chapter describes in detail the present-day procedure for the tin weighting of silk both in the skein and the piece. Particular attention is given to the development of new apparatus for weighting silk piece goods. The third chapter deals with chemical analysis and control as applied to the weighting baths and also with the analysis of weighted silks. The fourth chapter compares the relative durability of weighted and unweighted silk and discusses the methods which have been proposed to increase the durability of weighted silks. Dr. Scott occupied the position of chief chemist for Cheney Brothers for ten years and has been Chairman of the Sub-Committee on Silk of the Research Committee of the American Association of Textile Chemists and Colorists ever since its inception. Therefore, he is well qualified to speak authoritatively on this subject.

THE scientists of the present day and generation are chifly distinguished by their ability to upset all preconceived theories and beliefs. Their researches have been directed toward the acquisition of definitely established facts concerning the fundamentals of various chemical and physical phenomea which have been taken for granted for a great number of years. In some cases these researches have served to confirm and to amplify the earlier suppositions, but in many more cases the convictions which were so strongly held by our forefathers have been definitely proven to be false and unwarranted.

The weighting of silk is a typical example of the latter type. Here is a practise which was originally considered at its best a shameful adulteration of one of Nature's most beautiful products and at its worst a serious menace to the wearing qualities of silk fabrics. Banned by law in some localities and by public opinion in others, it was for a long time considered to be extremely unethical and was only carried out more or less secretly by firms who placed immediate profits above every other consideration. And yet modern research has clearly shown that if the weighting of silk is carefully carried out and is kept within reasonable limits, the strength and lasting qualities of the silk fibers are not at all impaired and in fact new qualities especially desirable for certain purposes are imparted to the silk. It is only faulty manipulation or overloading of the fiber which produce an injurious effect.

If anyone has the impression that this matter of introducing into the silk fiber materials other than silk for the purpose of increasing its weight, is of comparatively recent origin, the following extract from a proclamation issued by Charles I of England in the year 1630 will be of interest: "A fraud in the dyeing thereof being lately discovered, by adding to the weight of the silk in the dye beyond a just proportion, by a false and deceitful mixture in the ingredients used in dyeing, whereby also the silk is weakened and corrupted, and the color made worse." From this it is evident that the alchemists of those days did not devote all their time to a search for the Philosopher's Stone which would turn lead into gold. Perhaps they considered that it was just as worthy of their talents to produce two pounds of silk where formerly there was only one pound.

There are various other references to the weighting of silk in the literature of the seventeenth and eighteenth centuries but it was not until about the middle of the nineteenth century that really serious consideration was given to this subject. In 1855 a British patent was granted on the weighting of silk by means of double chlorides of zinc and barium and this was really a herald of the modern silk weighting industry. However, it was

not until 1883 that there is a patent reference to the use of tin salts for this purpose, and it was only in 1897 that tin is mentioned in combination with sodium phosphate and sodium silicate in accordance with the method which is in most common use at the present time.

There is appended to this article a bibliography of patents which have been granted in connection with the weighting of silk. A glance at this list will show that many chemicals, both common and rare, have been suggested. Although most of them have never come into practical use they present an interesting sidelight on the subject of silk weighting and for that reason are worthy of some consideration at this point. In analyzing the situation we find that of all the patents which specify materials for weighting purposes about two-thirds mention tin in some form or other as one of the ingredients and this is indicative of the importance of tin salts in the present-day methods of weighting.

Use of Tin Alone and in Combination

The salts of tin which are most commonly mentioned are stannous chloride, stannic chloride, pink salt (a double salt of stannic chloride and ammonium chloride) and sodium stannate. In the earliest patent, mentioned above, the tin is fixed on the fiber by after-treatment with weak solutions of sodium hydroxide or sodium carbonate but this treatment soon proved to be too harsh for the good of the fiber. Milder fixing agents in the form of successive baths of disodium phosphate, aluminum sulfate and sodium silicate were proposed by Bierman several years later and although his patent has long since expired, the process still lives and forms the backbone of the modern silk weighting industry. It will be described in more detail in a later section of this article.

Several other methods of fixing the tin on the fiber have been proposed as follows:—

1. After-treatment with sodium tungstate.
2. After-treatment with a solution of a barium salt made alkaline with ammonia.
3. After-treatment with lead acetate.
4. After-treatment with an alkaline solution containing trisodium phosphate and casein.
5. Neutralization with sodium bicarbonate followed by the usual baths of disodium phosphate and sodium silicate.
6. Addition of soluble sulfates, sulfites or hyposulfites of alkali metals, alkaline earth metals or aluminum.
7. After-treatment with complex acid combinations of tungstic or molybdic acids with phosphoric, silicic or boric acids.
8. After-treatment with various natural extracts such as gambier, logwood, sumac, etc.
9. Silk which is saturated with a tin salt is dried and then treated with ammonia gas diluted with some inert gas, followed by the usual phosphate and silicate baths.
10. Silk which is saturated with an alkaline stannate is exposed to an atmosphere of carbon dioxide and then immersed in the usual phosphate bath.
11. Silk is treated with acetates, formates or basic acetates of tin. These organic salts are then hydrolized on the fiber by exposure to steam.
12. Silk treated with stannous chloride is then immersed in a solution of acid ammonium phosphate containing a little free phosphoric acid.

Metals Other Than Tin

In addition to the many patents which deal with the use of tin in some form or other for the weighting of silk there are a number of other patents which suggest a great variety of alternative ingredients in this connection. Of course iron salts in connection with natural extracts containing tannin have been used for a great number of years for the weighting of black dyed silks and are quite familiar to all silk dyers. However, the salts of the following metals have also been proposed for use either alone or in combination with tin:— Lead, antimony, zinc, aluminum, chromium, manganese, calcium, barium, magnesium, strontium, titanium, zirconium, cerium, didymium, lanthanum, and beryllium. Out of this whole list the only metals which are used to any great extent at the present time are lead, aluminum, and chromium. These will be dealt with at some length in succeeding paragraphs.

Of all the rarer metals, zirconium seems to have received the most attention in the patent literature. One patent stresses the use of colloidal zirconium hydrates, another mentions zirconium sulphate tetrahydrate, and still others propose zirconium chloride, nitrate or aceto-nitrate. In most cases the zirconium salts are fixed on the fiber by immersion in a solution of sodium phosphate but in one or two instances the salts are hydrolized on the fiber by exposure to steam. Double salts of antimony chloride and sodium chloride (or other alkali metal halide) are said to be very satisfactory for the weighting of silk when fixed on the fiber by the usual after-treatments with sodium phosphate, aluminum sulfate and sodium silicate. A fairly recent patent proposes to treat silk with a solution of barium chloride, drying it, and then immersing it in a solution of a soluble sulfate such as sodium sulfate. This treatment would undoubtedly impart considerable weight to silk but it would also rob the silk of most of its natural luster and other desirable qualities.

Organic Weighting Agents

The silk weighting patents have by no means confined themselves to metallic salts. There are numerous references to the common natural extracts such as logwood, gambier, sumac, fustic, quebracho and gall nuts as well as pure tannic acid. Other organic compounds are less frequently mentioned but the following substances have been proposed at various times:— Granulated sugar, glycerine, colloidal rubber, albumen, casein and gelatine (the latter three products usually in combination with formaldehyde). Quite recently it has been stated that condensation products of sulfonated phenols with urea and formaldehyde are suitable for the weighting of silk. The possibilities of organic compounds of tin have been investigated by a number of research workers, most notably the brilliant scientist Egon Elöd. He concludes that a special tin salt

(Continued on page 539)

Handling Dyehouse Liquors

By **FRED. GROVE-PALMER, A.I.C.**

In the handling of liquors used in a dyehouse there arise many problems. There are many economies which may be effected in handling these liquors, and, in times like the present, it will repay many to investigate their methods of treatment, with a thought to decreasing expenses. The innumerable difficulties experienced in the dyehouse are fully discussed in this article.

THERE is a wealth of problems connected with the handling of the many liquids used in the dyehouse and bleaching department of the mill. When consideration is given to the fact that in all parts of the world the textile industry as a whole cannot be looked upon as being in a really flourishing condition, it is quite obvious that every attention should be paid to effecting all possible economies in the control and handling of liquors; in this direction there are many mills that may be able to bring about great savings in various directions.

There are, for instance, mills in which liquids are baled out of a tank by means of buckets and then tipped into the next. There are not many of these, nor are they among the important ones, but the outlook that makes such a thing possible is a wrong one, and should be altered because of its bad moral effect. Then there are mills in which the visitor may see too men lift a carboy of acid, say, on to a barrow, trundle it for some distance, and then, while one tilts the carboy, the other holds a jug under the lip and hopes to catch some of the contents, giving thanks to Providence if the strong acid does not splash up in his eyes and blind him. Possibly our prehistoric ancestors used these methods when they dyed each others' skin with woad, but they are entirely out of place to-day. There are plenty of means of emptying tanks and carboys quickly and without danger.

Since the beginning of the present century the inventors have done much to simplify and expedite the transportation of corrosive and harmless liquors both outside and inside the mill, and there is small reason why some or other of these improvements should not be adopted and adapted to cover practically every case that may arise. One of the oldest and simplest methods of handling acids and other strong liquids is the *montejus*, or acid-egg. This has been in use for fifty years or over in one shape or another, and there are still many who regard it as good as the best. Even if its engineering efficiency does not reach a very high standard, it is easy to use and it does the work expected of it without much expense. In it soriginal form, the "monjoo," as we used to hear it called, requires a man to operate it; he need not be a highly skilled man but should know what to do and when to do it, otherwise much air may be wasted. The apparatus itself is a cylinder of iron or steel with bowed ends; some are lined with lead and should be made in two parts bolted together with an airtight joint. Besides the manhole for cleaning out the sludge when necessary, there are four openings, often cast on with flanges. The first of them is connected with the storage tank and it for filling the egg with the liquor to be lifted; it is operated with a valve which should be kept in good trim. The second is merely an outlet for the air while filling; this is closed with a valve when the lifting is in progress. The third is the inlet for the compressed air, the expansion of which lifts the liquid to the desired height. The fourth is the delivery pipe which runs to the top of the building to which the liquid is carried. The inside end of this pipe dips into a dished recess in the bottom of the egg so that the whole contents may be blown out. As this end of the pipe is apt to be eaten away by some liquids, it is usually a short length that can be replaced without much trouble. As will be mentioned more fully later, all the valves require close attention to keep them in good working order.

From this description of the acid-egg, anyone not familiar with it will be able to see that it is an excellent piece of machinery for the purpose and is capable of lifting even strong sulphuric acid to a great height if the air-compressor is up to the work. The Kestner elevator and others have succeeded in making the montejus more or less automatic in action, which is an added advantage, though it will be found in practice with many liquors, that the self-acting valves require frequent attention and overhauling, especially when handling liquids that give off corrosive vapors, as they are somewhat apt to stick.

There are many other forms of airlifts and pumps of all kinds; perhaps, the commonest of the latter is the centrifugal pump which fits in with a large number of plant layouts. Although, this form of liquid transporter has all the appearance of being exceedingly simple, its action is controlled by certain mechanical principles which must be well understood by those responsible for the setting if the best work is to be gotten out of them; an engineer well skilled in other respects may not necessarily be a good pump setter. It is spoken of as a "knack" but in reality is knowledge of just what is required; it is by no means unusual to find pumps that seem to be properly set and yet are not giving the expected output. It may be that the pump is faulty; such a thing is not unknown, but far more often it is arrangement that needs alteration, and when a skilled technician handles the problem the

rate of delivery will be brought up to normalcy. Manufacturers of centrifugal pumps have turned their attention, not so much towards increasing the mechanical efficiency of their machines as towards the simplification of the setting with a view to obtaining good results, if not the best, with a minimum of trouble in regard to setting up; this has made for greater popularity as the certainty of getting good delivery is better than a chance of getting the best. These pumps are largely made of cast iron, steel or bronze, with a fair number of the acid-resisting, incorrodible nickel-chromium alloys. The extra long life of these latter may be taken far to outweigh the higher initial cost, and even to save money on maintenance, repairs and replacements. Some authorities give good reports on acid-resisting earthenware pumps, though the present writer is not in a position to corroborate them; it may be that the necessary skill in setting was lacking or perhaps the types of pumps tried out were not the best, though a fair choice was made. Certainly we failed to get results and the number of breakages ran the repairs bill so high that further experiments were discontinued.

There are a number of points that the pump maker should know about when purchases are being made, and it will be of further assistance if a representative of the suppliers can give the plant a once-over so that he may know just where the pumps will be placed and how the land lies around them. Some of the necessary information includes: quantity to be delivered, the action of the liquid on the material of the pump, the temperature, whether any vapor or gas is given off while pumping, the different effects on the pump of variations in concentration and temperature, the specific gravity, the delivery head, the suction head, and the possible presence of sand, stones or other abrasive or solid matter.

It is usual to express the delivery in gallons per minute; although a variation in the quantity is sometimes asked for there is not as a rule much scope for this, nor is it really desirable. The pump should throw up the maximum number of gallons in the shortest time and then stop. The temperature, specific gravity and the volatility of the liquid have all an important bearing upon the quantity delivered. If vapor is coming off the delivery is checked by temporary airlocks which means that the plant is pumping gas instead of doing real work; a heavy liquid is harder to raise, of course, than a lighter one. That is obvious, while it is more difficult to raise a heavy liquid in the cold weather than it is in the summer when the resistance in the pipes is less. The presence of solid matter of any kind in the fluid may cause considerable internal wear on the bearings; to prevent leakage these will need to be taken up. A common result of this is the raising of the shaft of the pump out of true alignment which leads to increased wear because of uneven packing. Realizing this, many pump makers have increased the length of the inside bearings and made the packing glands much deeper to allow for these contingencies. In spite of all, however, it may be taken as advisable in all possible cases to remove solid matter of an abrasive nature from the liquids before they enter the pumps either by straining or by settling in tanks.

The speed at which the pump is expected to work will be affected by the height to which the liquid is to be thrown, but the problems of delivery head are further complicated by such influences as may be exerted by the friction of the liquid on the pipes and its viscosity; information on the latter point is easily obtained but the same cannot be said always for the first. With the usual dyehouse and bleaching liquors, however, this point may not be of much practical importance, and can often be reckoned as similar to plain water, but with heavier liquids it would probably have to be ascertained experimentally. From a consideration of these matters it will be seen that though a certain pump will deliver a stated quantity of one liquid in a given time, it does not by any means follow that the output with another liquid from the same pump will be at the same rate. Feeding the pump by gravity from a storage tank will not give it the same amount of work to do as if the liquid has to be lifted from a pit and for this reason the suction head is of importance in gaging the work the pump can do. Then again, there is the question of working under pressure as in the case of circulatory pumps in pressure kiers. Here a definite performance will probably be asked for, such as the maintenance of 15 lb. pressure during the run of the shift of 8 or 12 hours, the liquor being drawn out from below and sprayed in at the top on to the batch of goods. Experienced users have shown that the best form of pump for this purpose is the horizontal, double-suction type with a divided casting, which has advantages over the kind with a side feed inlet.

As there are so many engineering firms who specialize in the making of pumps for all purposes there should never be any difficulty in getting just what is required. There is, however, one point that should be strongly emphasized: having all pumps, so far as may be possible of one standard pattern throughout the mill. The advantage can be pretty easily seen at a glance, but only when a half-dozen varied sizes have been turned out and replaced by one, that the lightening of the repair work and the reducing of the number of spare parts to be kept in store will be fully appreciated. Another point is seeing that all the flanges are drilled so that the bolts are in the same positions; much delay is sometimes caused by failure to notice this until trying to couple up, when the plant is brought to a sudden standstill in the middle of an important run. There is one mill in mind where the engineer foreman, an ex-naval man, who knew how to express himself freely in several languages, took fully five minutes to inform his chief that "there wasn't one pump alike in the whole place"; he certainly welcomed standardizing.

The circulatory system of dyeing, when acid liquors are used, often plays havoc with the metals used for pumps, unless they are carefully chosen. Vulcanite, or ebonite or some trade named composition of rubber and

sulphur, has been used for such situations, but here again the greatest care should be taken in settling upon a brand that will give satisfaction. Although it is found useful in the tin-weighting department when used with cool solutions, it is often found that when employed for boiling dye liquors, the high temperature softens the material and causes it to seize during the run. Another point in regards to pumps made of these compositions, is that the action of vulcanization does not stop when the pump is made but goes slowly on until a time comes when the substance becomes exceedingly brittle and will snap suddenly and (always) inconveniently. Another special material used for pumps that often gives good service is one of the ferro-silicon alloys. The only complaint made against them is that the alloy is inclined to be somewhat variable in composition owing to the difficulties attending manufacture. An instance of this kind occurred when two machines from the same maker were put in side by side under the same circumstances at the same time; one of them lasted exceedingly well but the other simply crumbled away in the space of a few weeks. Of course, it was replaced free of charge and the inconvenience was not great but the occurrence is quoted as an example of the kind of accident that the mill supervisor must be on the look out for.

Centrifugal pumps are usually driven by direct coupled motors; it is the most reliable method in almost all positions and is the most economical. In the dyehouse and bleach works special attention should be given to the packing of the glands as there are several ways in which a faulty packing can give rise to trouble. In the first place, the escaping liquor will probably damage the motor causing costly repairs; in the second, if the leak occurs when no one chances to be around, the loss of valuable liquor will add to the expenses, and in the third place, the fact of the batch that is under treatment being left dry will cause uneven bleaching or patchy coloring, involving costly processing to put right, if the material is not irretrievably damaged. Extra deep glands on textile pumps have been alluded to, but their presence should not prevent the person responsible for the matter making frequent close examination of the condition of the packing with a view to setting right any one that looks a bit shaky before the accident happens; the cost of repacking is infinitesimal in comparison with that of a spoilt batch of silk, let us say. The interposition of a sheet of metal as a screen in case a packing suddenly gives way is undoubtedly sound enough but it is rather apt to give a sense of false security to both the electricians and the finishers, and if anything does go wrong, the blame for it should not be allowed to fall only on the shoulders of the latter; the others should be made to feel that they, too, are equally responsible.

Having dealt fully with the pump problems and suggested ways of getting through or around them, it is fitting to give consideration to the matter of valves and the difficulties that arise in connection with them. Those in the tin-weighting department will possibly give more trouble than the ones in the dyehouse, but wherever there are valves holding back acids, weak or strong, there is apt to be trouble sooner or later. Sometimes they stick and are broken when someone tries to "turn" them with a 10 lb. hammer; sometimes they leak at the packing and may let a whole tankful of valuable liquid flow away to the drain before anything can be done, which is not only costly but can be very dangerous.

A certain measure of safety can be insured by putting two valves in series on the lead-out pipe from a store tank of corrosive fluid. The one next the tank would be kept open all the time, operations being confined to the other. In this way, should anything go wrong with the valve that is in constant use, the first can be shut off and the necessary repair or replacement made. To make sure that the first valve is working properly it should be closed at least once a day and then opened again and whenever opportunity offers, such as when the tank is empty, the packing of the first valve's gland should be renewed.

An excellent invention has been put upon the market comparatively recently in the shape of a glandless valve which solves many of the problems arising in this section of the chemical engineer's work. It is primarily intended for use in connection with such strong mineral acids as hydrochloric, though it is not suitable for concentrated sulphuric acid, nor a highly oxidizing liquid such as nitric acid. The principle upon which this valve works is the inclusion of a bellows valve made of shaped rubber which is actuated by the plunger in the ordinary way, shutting down on to a seating, also of rubber. Both these parts are renewable when occasion arises. The valves are marketed in all sizes and in two shapes, either straight run or right angled.

The pipe lines in the dyehouse and bleaching room are usually lead or iron; for some purposes it will be found that hydraulic steel piping will stand up better than either, and though it costs more in the beginning, its longer life and lower maintenance charges make it an attractive proposition. Another form of piping that is finding increasing favor is that which is rubber lined. Some makes of this piping have been found unsatisfactory owing to the rubber shrinking away from the metal and cracking, thus giving rise to leakages but in the kind that is put out by the same people who do the glandless valves this fault is guarded against by means of a patented junction solution which maintains a perfect and permanent adherence between rubber and metal. A further advantage is the non-hardening of the rubber lining; this is a fault which has been noticed in some makes. The fixing of a run of this form of piping does not involve any more trouble than that of ordinary lines; jointing rings are not required between flanges as the edge of the rubber lining is slightly raised so that when two are bolted together a perfectly tight joint is made automatically. There is another method of jointing in which flangeless pipes are used; a housing is screwed on which forms a tight junction.

Many of the tanks used in the bleach works and in the dyehouse also are lead lined. This applies usually to wooden tanks though not by any means always. It forms an excellent lining and has long life in the majority of situations, being useful for a wide range of liquids. Its great weight is something of a disadvantage, needing a very strong structure for its support, and when the contents are such that chemical lead burners are called in to do the work, it can be very expensive. The incorrodible alloys are growing in popular favor for tank work, and are good in every way. Here again the expense is the principal reason why they are not universally employed; it means the locking up of considerable capital but against that should be reckoned the sale value of the tanks, which can be removed to another place without difficulty. This could not be done with a lead lined wooden tank of any size without grave risk of injury. We have often used glazed earthenware vessels and have found them excellent within their particular limits. They must be well guarded against shock from outside, such as a carelessly handled trolley or a dropped spanner. Then again in cold weather they must be warmed up very carefully or a split may result. Only high grade tanks should be used otherwise the glaze may be found to give way and deposit flakes in the material.

Rubber lined tanks are very useful for many purposes; a wooden beck lined with soft rubber, if well done, should have as long a life as a lead one. Lightness is not the only advantage of this material as will be shown. The great difficulty has been to make the rubber adhere to wood, but that trouble has been overcome and it is now possible to get a junction solution that will stick rubber to anything that can be used for making tanks and vats: iron, wood, brick, concrete, tiles, and vitreous enamel when the enameling has cracked; nor is it necessary to have the groundwork perfectly dry or, in the case of wood, for the lumber to be well seasoned. It can be applied to old wooden tanks that are soaked and partially rotted.

In the artificial silk factory, the bleachworks and the dyehouse there are many wooden vessels; these are made of specially selected lumber from a seasoned stock that is known to withstand the action of the various liquids that will be brought into contact with it. This wood is somewhat expensive in some locations, and the making of the tanks is work for highly trained men who know just how to set up a watertight vessel. Well made, they have a long life but there must come a time when treatment they receive softens the wood and finally hydrolyzes it; then a new tank is required. But by using the solution to which allusion has been made, it can be given a coating of soft rubber that will add years to its life. Furthermore, if new tanks are to be lined in this way, there is no call for the best lumber, nor is it necessary to have the vessel made by a skilled tankman; the work can be done by any carpenter. The specialty of this jointing solution is that it carries the rubber into the pores of the wood and leaves a surface to which the lining will adhere without difficulty.

In the case of concrete tanks, a surface can be made which is impervious to dilute acids by treatment with the solution itself; there is no need for lining with rubber in every instance. It will not be as lasting, of course, but it serves for many uses as the solution has a larger quantity of rubber dissolved in it.

It is often useful to have casks and barrels lined with a proof coating; this is easily done by pouring in a quantity of the jointing solution through the bunghole and tilting the cask all ways so that the whole of the interior is covered. When the remainder of the liquid has been drained out, the inside will be found coated.

The material used for enameled tanks and basins is more adhesive than the others; it can be used for coating glass if the need should arise. All the linings here mentioned are untouched by the ordinary run of dyehouse and bleaching liquors, but it should be repeated that nitric acid and concentrated sulphuric will destroy them. It is possible that some of the stronger oxidizing bleaches would also affect them; this point would be taken up with the suppliers though, so far as experience goes, the usual milder bleachers have no ill effects.

It is not necessary to have the highest grade rubber for textile purposes; the second grade will stand up to weak acids, soap and ammonia, used alternatively, without any difficulty. The same applies to the usual dye baths.

A discussion of the best methods of handling dyehouse liquids would be incomplete without some reference to water, the most important of them all, from the point of view of quantity used. The water may be drawn from the district supply, from the mill's own wells, or from a neighboring river, lake or some other natural source. In these last it may be necessary to filter off mud, silt, sand or other forms of debris. Sometimes the placing of moderately fine wire screens across the intake is all that will be required, just slipping a fresh screen into position as necessity arises. More often it will be found that a properly made filtering bed is needed. A simple but still efficient bed is made by building a small lock in the intake, and filling this with graded sand and gravel supported on a bed of coke. This should be in duplicate to allow of cleansing from time to time without interfering with the run, though when the water does not contain a great quantity of suspended solid matter, the cleaning of the filter can be arranged at such times as the mill may be closed down for the necessary length of time.

Even the clearest water is not always suited for the purpose of the dyehouse owing to the presence of salts of calcium and magnesium in solution. Users of a water supply that is free from this hardness may be considered fortunate; others find it necessary to install some form of softening plant by means of which the offending substances may be removed. If this is not done, the reaction between the hardness and the soap used in the

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The Removal of Oil Stains From Indiana Limestone

By **WALTER E. HADLEY**

Two articles of a somewhat similar nature written by the same author have previously appeared in the *American Dyestuff Reporter*. The first (issue of Sept. 16, 1929) referred to the removal of an entirely different type of stain from stone, and the second (issue of Nov. 25, 1929) described the process of actually coloring one lot of building stone so that it would perfectly match another in the same building.

The present article is of interest not only from a technical point of view, but also because of certain legal aspects involved and the rather entertaining recital of certain phases of the human element which developed more particularly on the part of the curb stone onlooker who is omnipresent upon such occasions.

IN FEBRUARY, 1930, a new seven story bank building, in a thriving city of New Jersey, was rapidly nearing completion. The outside walls were practically completed, and the interior of the building was well under way, although much remained to be done.

Outside, the surroundings presented a chaotic appearance, at least to the layman. The sidewalks had not yet been laid, and the area was still literally covered with planks, pipes, and portions of stagings, which having served their purpose, only awaited the final clearing away.

Heat was need in certain sections of the new building. The heating system was designed for the use of fuel oil; large storage tanks, for the oil, being located in the basement. Delivery of this oil was to be from tank-trucks, the oil being pumped into the tanks through pipes having intakes on the level of the sidewalk. The tank-truck containing the fuel oil arrived, to make the first delivery. The operator made connections with an intake pipe, on the sidewalk, and started the pump. As a matter of fact, two other openings, one of which should have been used, were in close proximity, but these, unfortunately, were still covered with debris.

The Wall Is Damaged

The air pressure soon began to empty the truck and, for a short time, all seemed well. After several minutes of pumping, a deluge of dark brown substance was observed belching over the coping of the wall high above the ground, and flooding over the porous Indiana limestone which formed the lower portion of the building. Even then, it was not immediately sensed what it was, or where it was coming from, and by the time full realization of the catastrophe was grasped, the pump shut off, and the deluge stopped, the wall had to all appearances been ruined. The oil, instead of flowing into the storage tank, had been forced up a ventilation pipe located in the middle of the wall. The connections were corrected and the fuel oil still remaining in the tank-truck entered the storage tanks in the basement.

As is usual, in such extremities, no one was present who had the least idea what to do, and consequently nothing was done, and thus the oil had full opportunity to penetrate the porous limestone, and so deeply did it penetrate, that the oily appearance was largely lost, and a dull opaque character was imparted to the wall.

Diversified Interests Represented

As is customary, in construction programs of this nature, definite sections of a building, as finished, are accepted from the contractors by the future owners. The damaged section of the wall had not previously been accepted by the new owners, who quite properly adopted the attitude that they were paying for a perfect building, and would be satisfied with nothing else. Theoretically, they were not interested in the removal of the oil, but rather in replacement with perfect stones. Such a replacement would have necessitated the removal of the entire wall in the damaged area, at an estimated cost of approximately twelve thousand ($12,000.00) dollars. The necessity for the removal of the entire wall, was due to the method of construction where the facing stones were first set, and the back wall anchored to them.

The contractor's position was, that had the representative of the oil carriers, i.e., the truck driver, sought out a representative of the contractors, to make sure that the proper connection had been made, the oil would have entered the storage tanks, and no damage would have resulted. The blame seemed clearly to rest with the oil carrier, who, fortunately, was protected with insurance covering property damage. The final responsibility, therefore, was on the insurance company.

Inversely, however, when it came to a question of who was to decide whether the oil had been satisfactorily removed, the oil company, being covered by insurance was not concerned; although they had previously offered the services of their chemists in an effort to eradicate the oil stains. The insurance company was most easily satisfied,

they being willing to make final settlement, whenever a release clearing them, could be obtained.

The contractors were vitally interested for the simple reason that the damaged section of the building could not be offered to the future owners until the stains were fully removed, or until the wall had been replaced with new stock.

The future owners were most deeply concerned as the building, after once being accepted, became their property, and any permanent damage would be theirs as long as the building endured. Such was the state of affairs, when the author was asked to view the damage and, if possible, suggest means of restoring the stone to its original condition.

Consideration of Treatment to Be Used

At first, the contractors stated that they had the situation well in hand, and that the treatment being given under the direction of the oil company chemists was successfully removing the stains. In spite of this apparently optimistic viewpoint plenty of work yet remained to be done ere the damaged section of the wall would be cleaned of stains. As a matter of fact, after a short talk with the contractors, I was asked to express an opinion as to the method being employed, and was informed that gasoline mixed with whiting, contained in galvanized iron pails, was being applied to the wall with stiff brushes. A yellow colored gasoline was being used, and I drew attention to the fact that the wall already contained enough color without adding more. As to the efficacy of the whiting, it might have acted as an absorbent, if used in the dry condition, immediately after the accident, and prevented the deep penetration of the excess oil, but owing to the extremely fine composition would have a tendency to clog the pores and thus prevent the removal of the oil, even after the proper solvent had been chosen. The ever-present danger of fire was stressed, if gasoline in open containers was used.

The contractors were so impressed with the above line of reasoning that the experimental work was stopped, until such time as a conference could be held with the insurance company.

I had some small bottles of Ethyl Ether, Carbon Tetrachloride, Stoddard Solvent Naphtha, and a mixture of Ethyl Ether and Carbon Tetrachloride, and suggested that they might be interested in observing the action of these reagents on different sections of the stained stones. The solutions were applied with a clean piece of cheese cloth, and in each instance oil was drawn from the stone and the stained portions were materially improved. Following this demonstration, the contractors provided several blocks of Indiana limestone for experimental purposes. One of these was saturated with fuel oil, and immersed in a large jar of Stoddard Solvent Naphtha, and left soaking for a period of twelve hours, at the end of which time it was removed and dried in a steam heated oven. The rock was later pronounced perfectly satisfactory and the opinion was expressed that if the entire wall could be made to look as well, all would be satisfied.

There, however, the matter rested for several days, until finally a representative of the insurance company telephoned and asked me to report immediately to the contractors and proceed with the removal of the oil stains. It was arranged that the contractors would furnish the necessary labor, stagings, etc., and I was to supply the chemicals, prescribe the necessary treatment, and train and supervise the workman.

I had previously estimated that one workman would be able to clean the damaged stone in approximately one week's time, and that not more than fifty dollars worth of chemicals would be required. That this estimate was entirely out of line, was clearly shown when eight weeks were to elapse before the work would be finished.

Treatments Given

The first treatment consisted in rubbing Carbon-tetra chloride onto, and within the pores of, the stones. With the use of this solvent, a fairly rapid evaporation was noted, together with the removal of decided amounts of oil. The stains, on the rocks, were rendered decidedly lighter in appearance, and for several days, it actually seemed that definite progress was being made. On the evening of the fourth day, a rain storm, accompanied by a driving east wind, was upon us, and by the time the storm was over, it would have taken an optimist to believe that any progress whatsoever had been made in the removal of the oil. The wall was allowed to dry, and the treatment resumed. We were gratified to perceive that the first treatment, given after the storm, restored the wall to apparently the same condition as when we last left it, and we therefore felt justified in continuing the treatment with the Carbon tetra chloride.

Finally, the time came when little or no oil showed on the cleaning cloth, although a heavy stain remained beneath the surface of the rocks. It seemed imperative, therefore, that a less volatile solvent be employed, and it was reluctantly decided to use a Stoddard Solvent naphtha. While no doubt was entertained but that the naphtha would be fully as efficacious as Carbon tetra chloride, we realized that the longer time required for drying would keep the wall in an unsightly condition. Under the new treatment, it was soon evident that more oil was coming to the surface, which condition was undoubtedly due to the difference in the evaporation properties of the two solvents, which allowed deeper penetration with the solvent naphtha.

After the solvent naphtha brought the oil from the interior, an application of Carbon tetra chloride removed the surface oil, brought about a more rapid evaporation, and prepared the stone for a further naphtha treatment. These alternate applications were persisted in for a period of four weeks, each day seeing at least two complete treatments of the entire wall. Each night, and each week-end, the wall was left saturated with the less volatile solvent naphtha, in order to obtained the maximum penetration within the stones.

The very fact that the outer surface of the wall remained in an unsightly condition, at all times, and that

fresh oil was continually appearing on the wiping cloths, indicated that progress was being made, but the discouraging feature was that we had no way of telling to what depth the oil had penetrated.

Knowing full well, by this time, the large number of gallons of solution which would be necessary in dissolving the oil, I questioned if ever again a bank would be started in a more "solvent condition."

Need for a Definite Theory Early Apparent

Owing to the slowness with which the work progressed, I early felt the need of a very definite theory, as to what was taking place, in order that my explanation might uphold the morale of the workman, and it was only the knowledge that the evolved theory must be reasonably correct that gave us courage to continue the work. The most logical theory of which I could conceive was one which accepted limestone as being porous, and furthermore that these pores did not necessarily extend in parallel formation but consisted of heterogeneous mixture of microscopic channels running throughout the rock. The Indiana limestone being non-strata in formation, the blocks could be cut in any direction. If cut on a bias, the pores would run diagonally, in relation to the face of the finished rock. Thus the fuel oil lodged in any particular pore might extend for some distance just beneath the surface of the stone, and the only outlet for the oil would be the outer end of the tiny pore nearest the surface. It seemed logical that the pores must have been more or less open before the oil was spilled on the stones, and that the oil had filled every available opening to an indefinite depth. The pores, now being filled, could contain nothing more, and consequently the solvent could only act upon the infinitesimal layer of oil which was at the outer end of the pore. Such a theory was further visualized by considering a group of glass tubes, held in a vertical position, open at the ends, and bound together with a rubber band. If oil was poured into such a group of tubes, some would adhere to the tubes, but application of the proper solvent would quickly and thoroughly remove the oil. If, on the other hand, the tubes were sealed at the lower end, and then filled with oil, the solvent would only be able to remove the extreme upper level of oil, and the cleaning treatment would be prolonged until such time as all of the oil had been displaced with solvent.

Several attempts were made to speed up the work, at one time a trial being made with a motor-driven paint-sprayer, but the wastage of chemicals was excessive and it was finally conceded that the only solvent which did any good was that which actually entered the pores, and came in direct contact with the oil.

Day after day, as the onlookers saw the workman, with his small bottle of reagent, rubbing the wall with a cloth, the impression was created that we were trying to scrub the wall clean, whereas the whole object was to continually supply fresh solvent and allow the penetration and evaporation to draw the oil from the interior, so that it could be wiped off at the surface.

In the meantime, the bank officials were constantly viewing the wall, the contractors were worried as to the final outcome, and the insurance company was "marking time." At the end of four weeks, none of the stones was completely finished. The contractors wished to see a few stones from which the oil was thoroughly removed and, frankly, I, myself, had long had the same desire. It was than that I, personally, spent an entire day with the man on the job, and never, do I believe, did a bank, or any other building receive such a bath as was then administered.

When the treatment was first started, the real character of many of the stones was completely hidden by the oil stains, but gradually the different natural markings of the rock began to show, here and there, over the surface. A scrubbing was given with hot Ivory soap solution, followed by a thorough rinsing with hot water. Two lower layers of stone, which could be reached from the sidewalk level, were given this intensive treatment, and the remainder of the wall gone over with Carbon tetrachloride in order that it might become as dry as possible over the week end. After drying for two days, the lower rocks, which had received the special treatment, were examined, pronounced satisfactory, and the opinion expressed that if the entire section could be made to look as well, the work would be acceptable. But four additional weeks of intensive work were to go by before the job would be complete, four weeks which saw the constant need of "moral support" not only for the workman doing the actual labor, but also, and perhaps in even larger measure, for the one doing the supervision. In justice to the workman I must say that the work was extremely discouraging. The side of the building, on which the damage occurred, was on one of the main streets of the city, where a constant stream of people were walking to and fro, and not a few stopping, from time to time, to offer comments as to progress, or lack of progress, in the cleaning. The stained portion extended thirty feet in height and covered one entire bay between the windows, which were approximately eight feet apart, and spread onto the ledges of the adjoining windows. While the wall consisted mostly of plain blocks, the presence of carved stones, medallions, etc., presented special difficulties in the eventual treatment.

All day long, the laborer, working on a sixteen foot staging moved up and down the wall, a bottle of reagent in one hand, and a piece of white cheese cloth in the other, industriously rubbing, rubbing, rubbing, inch by inch, and wearing out yard after yard of cloth. After about two weeks of such monotonous work, and bearing up under the jibes and bantering of his fellow workmen, as well as the passersby, one morning found a new man awaiting my arrival, the first man having insisted that his foreman transfer him to another job. The new man, however, as soon as he was trained, proved to be a much more satisfactory worker, and one who followed directions implicitly, while at the same time willing to make suggestions, and use his ingenuity.

I was firmly of the opinion that no other treatment would suffice and that the only practical method was being used: and so the treatment was persisted in, day after day, with no variations except, now and then, during the last few weeks, alternate treatments with solvent naphtha and carbon tetra chloride were interspersed with hot soap treatments, followed with washes with clean hot water.

For eight weeks, all concerned had been on edge, wondering whether the work would ever be accomplished, and as the days lengthened into weeks those interested were divided into two camps, (1) those who firmly believed that the stain would never be removed, and who did not hesitate to say so, and (2) those who hoped that it might be cleaned, but were in no way optimistic. Possibly a third group of two people should be mentioned: one the workman on the job, who believed that it could be accomplished: but in this last group there were many times when only the workman believed, and he only through "good propaganda" on my part.

Outside Help Available

Throughout the entire time that the treatment was being given, numerous suggestions were offered, many in a kindly spirit, but none of which seemed practical, and many methods were suggested, a single application of which would have so stained the wall that it would have been impossible to remove the damage, and the entire section would have had to be replaced. One person was certain that "Babbit's Cleaner" would immediately remove all stains; nevertheless "Babbit's Cleaner" was not used.

A woman who lived across the street, and had seen the accident when it occurred, came to talk the matter over with me. She had some preparation which she was anxious to try, and could not understand why permission for her trial was withheld, but altogether too much was at stake to risk damaging the stones.

One morning, a man very mysteriously approached me, and with many apologies stated that, for days, he had been observing the wall, and following our efforts to eradicate the stain. He said, that during the preceding night he had dreamed about the work we were doing. I could not refrain from remarking that in this particular, he had nothing on me, as I had on more than one occasion had dreams regarding the wall, and that all of them had not been confined to my sleeping hours. He informed me that in his dreams, he had constructed a wooden dam about three inches from the wall; this he had packed with quicklime which he had later saturated with alcohol. He was gratified to find that the preparation, after remaining for two days in contact with the wall, had removed all the stains. I looked at the damaged wall rising thirty feet above the walk, and averaging eight feed wide, and decided that whatever our personal feelings might be we would not "Dam" the wall, at least not in the way suggested to him in his dream. I pacified him by suggesting that he return in the course of a few days during which time laboratory trials could be conducted to establish the efficacy of his dream. He did not return, neither were the laboratory trials conducted.

Odds Against Success

Occasionally word reached us that wagers were being placed about town and the odds at one time were ten to one that the stains would never be removed, and that the entire section of the damaged walls would have to be replaced. I was never able to learn, to my entire satisfaction, whether the wagers involved pennies, dollars, or cigars but interest was certainly evident, even among those who had nothing to win or lose.

One morning, as we were giving certain sections of the wall a rub with Ethyl Ether, in order to wipe off the oil which had been brought to the surface, and to obtain a quick clean drying, a woman was seen rushing toward us, shouting "Oh, what is that beautiful odor, Oh, let me smell of that bottle." The ether was contained in a four ounce bottle, and needless to say the bottle was immediately stoppered, and we disclaimed all knowledge of any odor which might have been present. She remained around for several moments, and when she left we resumed our efforts to "etherize" the building.

On another occasion, a man said he knew what would aid us, and seriously volunteered the information that "Bovine Excrement" spread on the wall to a depth of two or three inches would surely bring about a complete removal of the stain. In this case, we did not follow his suggestion, neither did we offer to make laboratory trials.

During the period when the general public was seriously questioning whether the work would really ever be successfully accomplished, a letter was received from a well known firm of Boston chemists, offering their services as consultants. While some doubt still existed, as to the eventual outcome, the oil was still yielding to treatment, and I felt that all was being done that was humanly possible. Aside from the original oil stains, the stones were still in perfect condition, and the point was stressed that no change should be made in the treatment at that time. Their offer was, therefore, held in abeyance, and the work continued along the original lines.

On the day which saw the final finishing treatment given, and while the workman was still admiring the results of his handiwork, two men appeared and asked where the oil stains were of which they had heard, saying that they had looked over the entire wall and could find no traces of oil at any point. They were non-plussed, and could scarcely believe their eyes, when told they were standing opposite the damaged area.

It had been understood, by the contracting parties, that the treatment would be persisted in for a period of three days, after oil had ceased coming from the stones. This was our only means of establishing that the solvent had reached the oil in the lowest depths of the pores. Finally, a time came when no more oil could be drawn from the rocks, which during the eight weeks received such intensive treatments, and were so thoroughly cleaned, that they did not match the rest of the stones in the wall. This con-

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Useful and Undesirable Mixtures of Dyes

By **RAFFAELE SANSONE**

ALTHOUGH the number of dyes produced by the different manufacturers is very large, it is necessary to mix some of them with other colors, in part for increasing the number of shades obtained by single or pure products, and in part for utilizing material that would otherwise find a difficult market.

Some of the above mixtures are useful, when prepared under convenient conditions, and with the most suitable products, for they bring advantages that would otherwise be impossible to obtain, and they cause no depreciation in the value of the dyed goods. Others are to be condemned, as they are sometimes the cause of inexplicable results, not only in the production of the different shades, but also in the fastness of the colored goods. Here the nature of the dyestuffs chosen by the color manufacturers as a shading means can play an important part, as can also the way in which they are mixed with the base or standard colors, the way the resulting mixtures are delivered to the consumers, and the way and condition under which they are employed for the different coloring operations.

Different Kinds of Additions

For utilizing unsuitable dyestuffs, or of increasing the sale of those already in some employment, by changing, in a portion, the shade, brilliance, etc., additions of supplementary colors of several kinds can be made, and they are as follows:

1. The very slight additions, that just serve for changing the shade of pure dyestuffs, rendering this more yellow, green, blue, brown, red, grey, violet, etc.

2. The small additions for brightening and shading at the same time.

3. The strong additions for imitating more expensive products, etc.

Quite small quantities of one, two or more dyestuffs are often necessary for correcting or changing the unsatisfactory shades produced by certain dyestuffs, and transforming these into marketable articles, that can be sold at a good price. It is here of the greatest importance that the products employed be in the finest possible powdered form, so that the very minute particles present when mixed in the very great mass of the base color, remain equally distributed in every portion. Otherwise it is possible when taking small quantities for the dyeing operations conducted later on a large scale, that a portion of the mixed dye will contain none of the added product, and another portion too much. Added dyestuffs, that have the least dyeing power, would give good results in this case as a larger quantity is required for obtaining the desired shade. A careful selection is however necessary as some of them are of too high cost, and others have an unsatisfactory fastness or solubility.

There is some difficulty in reaching the exact quantities to be used in the preparation of the mixtures, that have to correspond to standard colors, and very careful laboratory dyeing trials have to be conducted for the purpose. When only one color is used as an addition, a solution of a certain strength of the base color and a weak solution of the addition product are first made up. Three baths with 200 cubic centimeters of water, contained in three separate porcelain or glass beakers, are then mixed with a fixed volume of the strong color solution, for producing in the three cases a two per cent shade, or a shade with a higher or lower percentage in accordance with requirements.

At this point the colorist, by comparing the shade produced by the base color alone with the shade of the dyeing to be imitated, arrives at a small percentage, that is supposed to be that of the shading color, to be used for an exact matching. This percentage is transformed into cubic centimeters, that are then taken by means of a pipette from the weak solution indicated, and added in the second beaker, pouring then in the first one and a half times more, and in the third one and a half times less. The dyeing trial is next initiated with samples of five or ten grammes, distinguished by cuttings or holes, and continued for the time necessary for reaching the full intensity of shade.

The resulting dyeings are then rinsed, dried and compared with the pattern to be imitated. If the colorist has a good eye for matching, he grasps at once in this way the correct percentage to be taken, and if it has not yet been reached with one of the three samples, another dyeing trial is conducted. Through this arrangement, within a short time, one hundred grammes of the base dyestuff to be shaded can be mixed with the color chosen for the purpose, preparing from the resulting mixture a standard solution that is used at once for conducting another dyeing trial. In this way an exact matching should also be obtained, and the result can be communicated to the head operative charged with the large scale mixing operations, who can then prepare a large sized batch.

If the very small additions are composed of two or

more colors, the work of the colorist is much more complicated, and a larger number of trials is required for reaching an exact matching. The first dyeing is conducted in this instance with six different baths, and if preceding matchings are not available, it will be difficult to reach the exact percentage to be used in each case.

Additions for Brightening and Shading

In some works it is necessary to shade and brighten simultaneously colors that do not satisfy any of the requirements of the market, and here the basic coloring matters find a large use in a very finely subdivided condition. A certain care is however necessary for making the additions only where no precipitation can follow when the resulting products are dissolved. They are therefore only made after small, convenient, trials have been conducted in the laboratory. Very small, small, medium, and large quantities of one, two, or more basic colors may be required in accordance with the nature of the dyestuffs prepared and the use to which they are destined. The selection of some colors in preference to others may be necessary for meeting the price at which the final product has to be sold. The mixing operations should be conducted in all cases with the greatest attention, as an imperfectly prepared product can be the cause of very serious troubles, such as irregular shades having too much or too little brightness, or that tend too much towards an undesired color, complicating the task of the shader in the dyeworks, so that he may find it very difficult and even impossible to remedy some of the errors that follow.

Large Additions for Imitating Better Products

There are cases in which better products on the market are imitated with others of much cheaper price, by using additions of special dyestuffs to base or principal colors that not always reach fifty per cent. Here several inconveniences can follow, if a proper study has not been made before deciding on the products and quantities of these to be used. Some of these are caused by:

1. A change in the shade obtained from the dry dyestuff.
2. A change in the shade obtained from the solutions, caused by a portion of the dyestuffs remaining undissolved.
3. A weaker fastness of one or more of the added products when the dye is used for coloring purposes.
4. The unfavorable interference of some of the mixing colors when producing certain shades.
5. The production of duller shades by the presence of a large excess of unfavorable dyestuffs, etc.

The change in the shade obtained from the dyestuff can be caused through the granules of one or more of the shading products being much heavier than those of the base colors, so that during delivery to the clients they make their way gradually downward, especially if the mixture is excessively dry, the tendency being accentuated if the kegs are not filled completely leaving a certain space below the covers, and have been shaken continually. In this way the upper layer of dyestuff is freed, by the time the kegs reach destination, of all or of a portion, of the heavier shading products, while the layers immediately below contain too much of this, and those under them have a quite unsatisfactory color.

For avoiding the above troubles some dyers, before taking any dyestuff for the matching operations, have the custom of mixing well the contents of the kegs through the assistance of a wooden stick. The action of this is not however always sufficient to avoid the presence of more shading color in some portions in comparison with others. Some dyers insist on having all their dyestuffs delivered in tins, and in these any mixture can be uniformly distributed by an energetic shaking up and down, so that the portions taken out at the beginning are equal to those used later.

Cases may arise where the mixture dyestuffs are so little soluble that although being dissolved, they form a light opaque suspension in the bath, from which the color is absorbed less uniformly than from the base color solution, or just the contrary may follow. The shading dyestuffs, through the special conditions adopted in the dyeing operations conducted on a large scale, can be absorbed completely by the textile treated, before the whole of the dyeing power of the base color has been utilized, and this may bring a difference in comparison with the trials obtained on a small scale in the laboratory.

For obtaining the best results the added dyestuffs should have the same, or a slightly superior, fastness to that of the base color mixed with them, but not less, as in the small quantities in which they are sometimes used this can be smaller than if the same coloring matters were dyed in medium or dark shades. If the dyestuffs, used for shading the base colors, are less fast than these last, an unfavorable change in the shade takes place, during a soaping for producing a scroopy effect or for other purposes, requiring a supplementary dyeing for returning to the tone demanded by the client. In some cases a weaker fastness to light can be shown through the goods changing shade in the portions that have been exposed more or less strongly to light in the shop windows. Small, carefully conducted, laboratory trials being of the greatest importance for avoiding a similar inconvenience.

Certain shading colors can interfere unfavorably when the dyer produces with them his usual shades, by giving dullness or different results in comparison with the colors employed before. For this reason, before a mixture is adopted, it should be first tried in the laboratory for producing such shades and observing if any difference follows.

Arrangements for Avoiding the Separation of the Shading Colors

There are several important means at disposal for avoiding the separation of the shading dyestuffs added to the base colors in small or large amount, and they are:

1. The mixture of dyestuff powders having granules of exactly the same size.

(Continued on page 543)

Proceedings of the American Association of Textile Chemists and Colorists

The American Association of Textile Chemists and Colorists

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CALENDAR OF COMING EVENTS

Annual Meeting
December 4, 5—Boston.

* * *

Bleaching With One Hundred Volume Hydrogen Peroxide*

By D. S. Quern
Buffalo Electro-Chemical Co.

When first asked to present a paper on hydrogen peroxide bleaching before this meeting, the title suggested was "Bleaching with Becco, the prepared Hydrogen Peroxide." Insofar that this would indicate that the peroxide is ready for immediate use, it is correct. It is not, however, produced as a derivative from another peroxide compound, but is made by an electrolytic patented process, known as the Pietzsch Process.

This method is as interesting as it is efficient, and consists of steam distilling potassium persulphate which in processing has been prepared to the highest degree of purity, and producing thereby concentrated hydrogen peroxide which is condensed and diluted to 100 volume strength. This particular process differs from the persulphuric acid process, producing low volume peroxide which is subsequently brought up to the concentration required. The concentration, 100 volume, at which this peroxide is furnished indicates of course that there are one hundred available volumes of nascent oxygen for any given volume or measure of the concentrated hydrogen peroxide.

The Pietzsch process for making concentrated hydrogen peroxide produces a chemical which is of the utmost purity, and consequently of the utmost stability. It is therefore free from preservatives of any nature, since it requires none and is very slightly acidified with phosphoric acid. Hydrofluoric, hydrochloric, or sulphuric acid used in this connection will form fluorides, chlorides or sulphates with alkaline solution which may break silicate of soda, throwing silicic acid into the bleach liquor. Phosphoric acid proves, therefore, most satisfactory for the purpose described, since phosphates do not have the same deleterious effects on silicate.

It can be seen therefore that the concentrated hydrogen peroxide produced by this process reaches the bleach house, whether it be for wool, silk, or cotton goods, completely free from any impurities whatever, of a stability which will withstand the most rigid tests, and comes in form ready for immediate use.

*Presented at the Organization Meeting of the Southeastern Section.

The methods employed in using this hydrogen peroxide differ somewhat depending on local conditions existing in the various bleacheries. The underlying principles are very similar, however, and a brief discussion of the equipment and methods employed on cotton piece goods can be given here. Piece goods run on a small scale are bleached in machines very successfully, but for large scale operations with peroxide, kiers are used. The kier most favored for this purpose is equipped with a pump and overhead spray, and with either an outside heater or closed coil heating system in the false bottom. Steam jet or inspirator kiers are sometimes used and with great success. Objection to this type kier is found chiefly in the fact that the heating and circulating system in itself produces dilution of the bleach liquor, a feature which is naturally undesirable in peroxide bleaching.

Both iron kiers and iron mixing tanks are used very widely for hydrogen peroxide bleaching. This is the case because such equipment has already been a part of those bleacheries which have changed from a chlorine process to a hydrogen peroxide process and have found their existing equipment adequate. The fact that hydrogen peroxide bleach baths can be made up successfully in existing iron tanks proves advantageous to bleacheries running caustic pressure boils followed by a peroxide bleach in that two sets of mixing tanks are not required. It must be noted, however, that iron is an active catalyst on peroxide solutions, and this feature is taken care of by adequately coating iron equipment in which these solutions are used.

In many cases, however, we find differences from the above in that the equipment may consist of wooden mixing tanks and iron kiers, or possibly all wooden tanks and kiers. This is of course excellent from the standpoint of avoiding any catalytic effect on the peroxide solution, but imposes limits on the durability of the equipment and methods by which it can be used.

While it is possible to bleach goods wet out and loaded into the kiers without any preliminary treatment, some form of preparation is customarily given before the bleaching operation. In the case of print cloth, broadcloth, or similar fabrics, this preliminary treatment may consist of a desizing operation, grey souring, and pressure boiling, followed by a light peroxide boil in the same kier. Certain classes of colored goods are given short preliminary boils, and other classes of goods may be first desized and then immediately bleached. The different methods employed are based on the variables existing in the different plants, such as the type of goods to be bleached, the time element in particular and other factors of importance. By this is meant that if high speed bleaching is required it can be done by using stronger chemical concentrations and consequently higher chemical costs; the lowest cost chemically is obtained by taking the longest time on the preliminary processes. There is, however, a balance at this point where peroxide will render the best service in the saving of time while being performed at a reasonable chemical cost.

The amount of peroxide required for the bleaching operation in the kier varies according to the preliminary operations and the quality of cloth to be bleached. From one to three per cent by the weight of the goods in the kier will ordinarily be required. This method of calculating the amount of peroxide is most frequently used, and yet strictly speaking is not correct. A certain concentration of peroxide in the kier liquor is necessary and this, of course, depends on the amount of water used. Four per cent by the weight of cloth in the kier with an over-generous kier liquor will only be equivalent to three per cent by the weight of the goods both in concentration and resulting white, where the second kier has correspondingly less kier liquor. The principle of calculating by per cent of peroxide on the weight of the goods will no doubt always be used widely because of its simplicity and it is only necessary to say that if this is done the amount of kier liquor used should be no more than necessary to maintain a strong constant spray over the top. In this regard, of course, kier liquors may be tested and followed for oxygen concentration by the use of potassium permanganate.

The time and temperature required are other factors to be considered. From three to ten hours may be taken in bleaching the cloth, the more extensive the preparation, the faster the bleaching operation, and vice versa. The bleaching temperature usually ranges from 180° to a boil, the higher temperature accelerating the bleaching operation, but with temperatures under boiling most frequently used. Following the bleach in the kier, the goods are washed out into the white bin, skipping subsequent processes required in chlorine bleaching.

The exact amount of cloth which may be bleached in a peroxide kier is a matter dependent largely on the class of material being bleached, and the processing given. Larger amounts of cloth are handled usually in kiers first pressure boiled than in those receiving less treatment, since cloth in such a case tends to pack more closely after the first boil and hence rises less during the second or peroxide boil. Also, the lesser amounts of peroxide required after pressure boiling must be considered in this regard.

It is best, however, not to overload a peroxide kier and if possible to allow it to arise as it will without the use of chains, ropes, or wooden blocks to hold the cloth down, since this freest movement of the cloth is most desirable. Chains, of course, are used in many instances when the conditions or open nature of the kier equipment make this necessary.

In the application of the hundred volume hydrogen peroxide process, certain differences are noted from

peroxide processes, employing a peroxide derivative, such as sodium peroxide, and bleaching with chlorine, or the frequently termed chemic bleach.

It is simple to make up a bleach solution with hydrogen peroxide. When poured into the water in the mixing tank, no chemical reaction takes place; all that occurs is simply a dilution of the concentrated liquid to the strength desired, and there is not any loss of available oxygen in this dilution process.

A hydrogen peroxide bleach bath is not only easily prepared, but in addition, since it avoids the use of sulphuric acid in mixing, it forms no sodium sulphate or Glauber's salts to be carried over into the kier solution. Sodium sulphate in a bleach bath together with sodium silicate tends to form a take place to such an extent that pipes will clog and involve possible replacement, since there is no mechanical means by which heavy scale of this sort can be removed. Steam coils becoming heavily coated in this manner become insulated, making it gradually more difficult to get up heat in the kier and resulting in greater steam consumption. Elimination of Glauber's salts from the hydrogen peroxide bleach bath eliminates any such possible conditions.

Then, too, it must be noted that sodium sulphate present in a bleach bath tends to break silicate, throwing it out of solution as a jell-like substance which will spatter from goods when being pulled from the kier.

It may as a matter of fact be said that the user of liquid hydrogen peroxide carries an insurance policy, requiring no premiums, since it can be used at reasonable cost and paying big dividends in safety and simplicity of operation. It takes into consideration the human element; any error on the part of help making up bleach solutions would have no serious effects, such as might be the case in the use of other mediums.

Coming to the comparisons between hydrogen peroxide and chlorine, it may be remarked that hydrogen peroxide is a method of hot bleaching compared to cold bleaching with chlorine; and that it is a method of bleaching in the kier, compared to simply boiling in the kier and performing the bleaching operation outside.

Bleaching of such materials as colored shirtings, yarns, knit goods and towels is very widely accomplished today with hydrogen peroxide. Bleaching of colored goods by this method is extremely simple and safe, and involves no risks such as are sometimes incurred in bottoming such goods sufficiently for a chemic bleach.

In recent times, however, hydrogen peroxide has reached a degree of expansion which has brought it into direct competition with a chlorine bleach on lines such as print cloths, pajama checks, etc., which have not heretofore been considered practical because of unfavorable price comparisons. This expansion has been caused by certain factors existing in different bleacheries, these factors varying in intensity and importance.

These factors are based mostly on the principle of peroxide as a kier bleach. Labor required in after processes is eliminated and considerable water may be used, a serious item in places where water is obtained expensively. There is also a certain saving in equipment and consequently a great saving in space required for bleaching. This factor is particularly important to any bleachery contemplating enlargement of production without feeling called upon to enlarge their buildings, and the compactness of peroxide bleaching is most important to anyone planning the erection of a bleachery. Evidence of its importance is seen in the fact that several large bleacheries have lately been designed and built especially for peroxide bleaching.

Another point to be noted in peroxide kier bleaching is that considerable pulling of cloth around a bleach house is avoided. Less handling of this nature will result in straighter fillings and cloth in better condition, especially in the case of light fabrics such as scrims, marquisettes, etc.

During recent times hydrogen peroxide has come forward as a bleaching agent for cloth to be dyed. In this field it offers striking possibilities. Since peroxide is applied as a hot bleach over a period of several hours, the cloth thereby receives another boil which adds so much of benefit to the preliminary preparation. Again, since the cloth is washed directly into the bin from the kier without being pulled through the additional processes required for chlorine, the points of contact for this cloth are considerably reduced and obviously there is less opportunity for rub marks.

While other comparisons might be outlined, those dealt with have played a large part in the rise to importance of this bleaching process. Since it first became used on a large scale a few years ago, and has already risen to the high degree of importance it occupies today, it is reasonable to expect it to attain continually improving efficiency and likewise continual expansion.

ASSOCIATION BADGES

The lapel button badge illustrated herewith is worn by members of the American Association of Textile Chemists and Colorists.

The three "rings" are enameled in red, yellow and blue, respectively, and the initials and border are brought out in gold. The general effect is exceedingly attractive.

Badges may be secured at $1.50 each by addressing the Secretary.

ALEX. MORRISON,
American Woolen Co.,
Andover, Mass.

AMERICAN DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

LOUIS A. OLNEY
Professor of Chemistry and Dyeing, Lowell Textile Institute
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COOPERATION AND CONCENTRATION

ONE of the reasons advanced for the demise of the Wool Institute was the lack of cooperation between the Institute and the industry. The lack of cooperation manifested was on the part of the industry. The membership of the Institute was composed almost entirely of smaller companies, and the larger concerns, one in particular, declined to accept membership. With the larger concerns not cooperating with them, it is obvious that the good that the Wool Institute could accomplish was more or less limited and the result was the dissolution of this organization a short time ago. Without the cooperation of the bigger plants the association was powerless to function except to a limited degree and consequently its accomplishments were not what they properly should have been. Lack of support was no doubt the vital reason for the disbanding of this association. A statement made by A. D. Whiteside after his retirement as president is significant. It was as follows:

"Cooperative effort in this industry up to the present time does not superficially appear to have proved successful. But these efforts, in which a few of the outstanding men of the industry have sincerely and honestly participated, will have a deep and lasting effect, for it may be as a result of these organization meetings that an important number of the men of this industry have either changed or modified their viewpoints toward the production or marketing of woolen and worsted piece goods."

Other trade associations may benefit from the knowledge of the cause of the downfall of the Wool Institute. There are innumerable industrial organizations throughout the country that are rather small and insignificant, with a limited amount of power, and serving a limited branch of industry. Many of these, because of their lack of power, are finding it difficult to conduct their activities. In the case of these small associations it would be better to concentrate their activities by organizing one large institute to serve all of their respective industries. Many of these associations are so closely allied in their interests that they are undoubtedly working on similar problems. With a large organization of industrial societies of closely allied in-branches, it would have greater power to act, and it would have a greater chance of permanence. Such an association would cause the larger industrial concerns to become members for their own benefit. The larger the organization, the greater its power. With its increased power it would compel a larger membership and a larger membership would insure worthwhile accomplishments.

NEW FOR OLD

IT MIGHT be said that we can estimate the industrial progress of a nation by the size of its scrap heaps. Generally speaking, the progress of a nation reflects the progress of its citizens through the advancement of its individual industries. But it also represents the average advancement and the thought of this editorial is directed toward those concerns which are below average—below average in taking advantage of new ideas and processes and in scrapping old machinery for new and more efficient modern machinery.

The responsibility for the "below average" concerns rests upon the business leaders who are conducting the affairs of these companies. An efficient business leader should have the following qualities. He must be executive minded, organization minded, finance minded, and market minded. Let us consider the first of these. To be executive minded emphasizes the fact that the alert business leader must keep abreast of new developments, which bring with them the introduction of new machinery and new processes. It is impossible to be efficient producers in applying antiquated processes in conjunction with obsolete machinery that should have been scrapped years ago. Furthermore, it is, in cost cases, impractical to use old equipment in carrying out modern manufacturing specifications. Hence it is evident, that to secure the advantages of modern processes, we must have the apparatus to correctly apply them.

Any business leader who refuses to buy new and essential equipment on the basis that he is saving money, is not only wasting the firm's money by trying to work with unsuitable equipment, but is also paving the way to an early finish because of a lack of means to meet stiff competition.

Further we cannot give an executive credit for being organization minded if he is not properly equipped for efficient organization. Neither can we say he is finance minded if he refuses to spend money for necessities and then wastes it by trying to adapt old machinery to new methods. Finally if he is unable to meet the demands of a modern market because of out-of-date practices, we cannot say that he is market minded.

There seems to be a heavy atmosphere surrounding some business men that holds them to the old and renders them immune to changes. However, those who will not accept the new are bound to be left behind.

Silk Machinery Exposition

A silk machinery exposition will be held in the Paterson Armory in Paterson, New Jersey, from November 14th to November 21st, 1931. In conjunction with this the Paterson Silk Institute will be held on November 14th and the National Silk Convention will be held on November 18th and 19th.

The Show will open on Saturday, November 14th at 7 P.M. and will be open each and every day thereafter from 1 P.M. until 10:30 P.M.

The exposition is under the direction of John J. Fitzgerald. The chairman of the National Silk Convention is C. Walter Lotte, President of the Board of Public Works. The Silk Machinery Exhibition has R. DeVere Hope of the National Silk Dyeing Co. as chairman. The chairman of the Silk Institute is Ernest Barber, silk expert and consultant.

DuPont Purchases Newport

E. I. du Pont de Nemours & Company has entered into an agreement to purchase the dyestuffs and chemical business of the Newport Company subject to the approval of the stockholders of the latter. The wood distillates division of The Newport Company does not figure in the transaction.

The Newport Company plants involved are at Carrolville, Wisconsin; New Brunswick, New Jersey; and Passaic, New Jersey. It is the intention that this additional dyestuffs and organic chemical business shall be consolidated with the dyestuffs business of the du Pont Company. It is also the intention that the policies and operations of the acquired industries shall be continued substantially as heretofore.

Newport has been an outstanding contributor to the upbuilding of the American dyestuffs industry and its activities along many important lines of research, development and production have been conducted most successfully. The company states that the combined facilities of the consolidated organizations will enable the du Pont Company to offer an even better service to the consumers of dyes and organic chemicals.

Hosiery Colors

A display of Modern Girl hosiery is now being featured in one of the Boardwalk windows of the Du Pont Exhibit in Atlantic City. The stockings are shown in all the popular shades including Sandee, Tanblush, Reve, Mayfair, Matinee, Tendresse, Champagne, Beige Clair, Pearl Blush, Ivoire, Caresse, Dream Pink, light Gun Metal, dark Gun Metal and White.

Du Pont dyestuffs are used in producing the colors featured in this line.

Polish Production of Coal-Tar Derivatives

According to Commercial Attache Clayton Lane, Warsaw, production of coal-tar crudes by nine Upper Silesian coke plants, during the period January 1 to March 31, 1931, was as follows: Crude tar, 17,619 metric tons; crude benzol, 3,823 tons; and ammonium sulphate, 5,439 tons.

The production of distilled coal-tar products during the same period is shown as follows: Prepared tar 3,767 metric tons; tar oils, exclusive of benzol, 5,961; pitch, 9,633; naphthalene, raw, pressed, 440; naphthalene, pure, 174; pyridine and pyridine bases, 19; phenol and cresol, 1,901 tons.

The production of coal tar and its derivatives continues to reflect the somnolent trend which obtained at the end of 1930. There has, however, been a slight increase in the demand for raw tar, pitch, and impregnating oils, but this is wholly seasonal. Market tendencies have served to decrease accumulated stocks. The immediate prospects for increased demand are slight, although trade circles assert that the inauguration of the National Road Fund will stimulate the general demand for raw and prepared tar. It is also expected that foreign markets will manifest increased demand for Polish distilled coal-tar products, because of additional price reductions.

Joins Swann Organization

Theodore Swann, President of The Swann Corporation, announced recently the appointment of George Y. Frankle as Sales Manager of Swann Chemical Company. He will succeed Robert S. Weatherly, who has been made Vice-President of Swann Chemical Company.

Mr. Frankle comes to The Swann Corporation from the Grasselli Chemical Company, after an association of seventeen years.

Mr. Weatherly has been with the Swann organization since 1923, holding the position of Sales Manager since 1928. He is also Vice--President of Federal Abrasives Company, a Swann subsidiary.

Both Mr. Frankle and Mr. Weatherly will have headquarters at the main offices of The Swann Corporation in Birmingham.

Suprafix Dyestuffs

General Dyestuff Corporation releases Suprafix Dyestuffs. The first five brands which are illustrated are:

Indanthren Yellow 3 G Suprafix double.
Indanthren Golden Yellow R K Suprafix double.
Indanthren Yellow Brown 3 G Suprafix double.
Indanthren Brilliant Violet B B K Suprafix.
Indanthren Printing Black B L Suprafix.

The advantage of this new class is that complete fixation is claimed in a short steaming. The circular issued by the company shows that prints aged only 3 minutes are equally as fully developed as those which are aged 5 minutes.

Dyeing Artificial Silk Fabrics*

The Value of Load-Extension Diagrams in Ascertaining the Properties of a Fabric

By JOHN ECCLES

WHEN a specification of a cloth is drawn up it is naturally anticipated that the counts (the numbers of ends and picks per inch) of the fabric in the grey state will differ from those in the finished state. A considerable number of factors are involved here and many of them will occur at once to the reader. It is not the purpose of this article to discuss these considerations in any completeness, or even to mention the majority of them, but to deal rather with some aspects of the results of scientific examination of the materials, insofar as they throw light on the question.

Mixed Fabrics

It sometimes happens that the anticipated results are not obtained. As an example, let us consider a cloth with a crepe cotton warp and an artificial silk weft. The expected shrinkage and consequent increase in the number of picks per inch may not materialize and questions arise as to how the cloth may be rectified and how the trouble can be avoided in future.

The dyer and finisher rightly and wisely uses the knowledge accumulated in the past, and when new materials come along the old practice is modified, if and where it may be necessary. Consider for a moment the treatment subsequent to weaving of a cloth composed entirely of wool. The cloth may have required more scouring than was expected. In this process a certain amount of milling is inevitable and appreciable shrinkage of the fabric takes place. This, however, need not greatly perturb the finisher. He knows from long experience of the behavior of the material that he will be able to restore it to the required length and width by the judicious application of tension, under the requisite conditions, and that finally he can set the cloth as required. Turning now, for comparison, to an all-rayon cloth, composed of low twist yarns, an entirely different state of affairs would almost certainly be found. The cloth would, in all probability, have stretched in length rather than shrunk and the finisher would be unable to cause it to shrink to its original dimensions.

Common Examples

Such examples are, of course, very familiar to everyone with any knowledge of dyeing and finishing and an enquiry as to the reasons for such differences is natural. The scientific examination of the materials and the determination of their fundamental properties not only provide the answer, but even predict the phenomena observed. Such prediction affords a very strong argument in favor of its efficacy.

It may seem a far cry from a fabric to the load-extension diagram of a yarn, filament, or fiber, but, as will be seen later, the connection is really very intimate. The load-extension diagram affords the best known method of exhibiting the properties of a material and, rightly interpreted, its indications offer a valuable guide to the correct handling of the material in process. Frequently the load-extension curve is referred to as the stress-strain diagram, but the first description is better and more strictly accurate since the load and the extension are actually the observed quantities whilst the stress and the strain are calculated from them. The load-extension curve gives the load carried by the specimen of yarn or fiber at every stage of the process of loading the fiber until it breaks.

Rupture of the Material

The finisher, naturally, protests that he is neither concerned with, nor interested in, the breaking of the material. In fact, it is generally true that the portion of the load-extension curve dealing with the rupture of the substance is of much smaller value and interest than the preceding parts of the curve. The initial part of the curve is of the utmost importance, for it tells to what extent tension may be applied without permanent damage to the material being caused.

With the methods of obtaining the load-extension curve we are not immediately concerned. It is usual to employ for its determination one of the testing machines now available. These are generally arranged so as to draw the diagram, while the test is being made. This is the most satisfactory method and is the one by which the curves discussed below have been obtained. For the purpose of developing the argument, it will be best to consider first the general interpretation of the load-extension curve and then to consider specifically the curves of natural fibers, such as wool, and of the artificial silks, such as viscose and cellulose acetate.

How the Curve is Made

The load-extension curve in its simplest form is given by a metal wire such as copper or iron. The curve is shown in Fig. 1. The load or tension is measured vertically and the extension or elongation is measured horizontally. The curve can be divided into three parts, OA,

AB and BC. The first portion OA shows no perceptible departure from the straight line. For loads not exceeding OP the material is said to be perfectly elastic. The reason for this is as follows: If the wire is stressed by any load not exceeding OP, to an extension not exceeding OQ, and the load is then removed, it will be found that the wire has returned to its original length, i.e., there is no permanent extension.

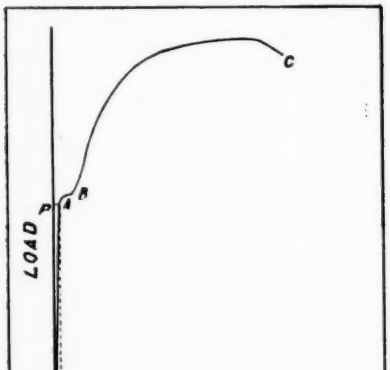

Fig. 1.

At the point A the curve departs sharply from the straight line and a much greater extension for a given increment of load is observed. If a load greater than OP is applied it will be found on removal of the load that the wire does not return to its original length but that it is permanently extended. The point A gives the "elastic limit" of the material, a knowledge of which is of vital importance. The portion AB of the curve is usually more or less curved. In the third portion of the curve, commencing at B, the curve becomes steeper again but not so steep as in the initial part OA.

The Rupture Point

The load goes on increasing for a time, as the wire is stretched, and usually falls slightly, as shown, when it approaches the point of rupture C. This general explanation of the load-extension curve makes no pretense at exhaustion of completeness.

Turning now to the curves for textile materials, Fig. 2 shows the curve given by a wool fiber and this curve is also substantially representative of that of real silk when in the form of continuous filament yarn. Fig. 3 shows the type of curve obtained from a filament of rayon, or a continuous filament rayon yarn. The curve for a wool fiber has been chosen because it is a little simpler in character than that of a yarn, since there is no fiber slip when a single hair is used, and yet its general characteristics are the same. These diagrams reveal at a glance the histories of the happenings when the loads on these materials are steadily increased from zero to the breaking load.

A Three-Part Curve

It will be seen at once that these curves exhibit a behavior similar to that of the metal wire in Fig. 1. In each case the curve can be divided into three portions similar to the divisions of the metal curve. For the wool curve, the initial straight part is not so steep as for the first part of a metal curve, as would be expected. From the slope of this part of the load-extension curve the value of Young's Modulus for the material may be found. This modulus of elasticity is defined as the ratio stress divided by strain or load per unit of cross section divided by extension per unit length. Metals have higher moduli of elasticity than textile materials and therefore the initial parts of their stress-strain diagrams are steeper. This, however, need concern us no further here. As with the wire, the wool curve starts as a straight line and exhibits a somewhat ill-defined elastic limit where the curve departs from the straight. The bending over of the curve gradually increases until the breaking load is reached.

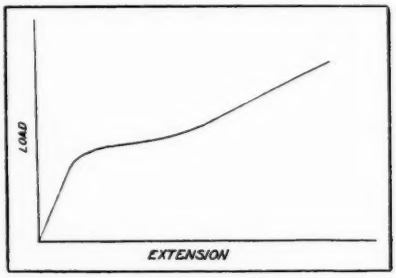

Fig. 2.

Referring to Fig. 3, a clear departure from the form of the wool curve will at once be noticed. The curve starts similarly to that of the metal or wool curves and exhibits, like the wool, an ill-defined elastic limit. Just above this elastic limit it will be seen that there is a relatively enormous increase in extension with very little increase in the load. This portion of the curve is best described as the region of plastic flow. The material is behaving like soft putty in that very little force is required to deform it and the material makes little attempt to resist the deformation. In the third part of the curve, the rate of increase in extension as the load increases falls off, the curve becoming steeper though not so steep as in the first portion of the curve.

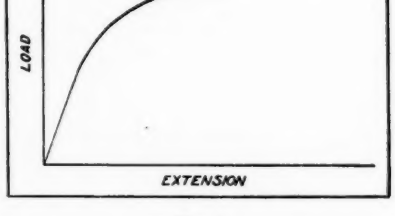

Fig. 3.

The characteristic load-extension curves for artificial silk in the dry state have now been described and explained at some length and compared with the curves of natural fibers like wool and silk. As the subject under discussion is the explanation of properties which are concerned in dyeing and finishing fabrics it will be necessary briefly to notice the curves of the materials in the wet state. It will suffice for the immediate purpose to describe briefly the differences between the curves in the dry and wet states.

The general form of the curve in each case is the same, in that it is divisible into portions, similar to those making up the dry curves. In the initial parts, the curves for wet material are less steep than those for the dry substance. This is a very important point to which reference will be made later. The elastic limits in the wet state are lower than those in the dry states and so are the ultimate breaking loads. In the case of the artificial silks the plastic region is of greater extent for wet material than for dry rayon. It cannot be too strongly emphasized that this region is full of trouble for the dyer and finisher of rayon fabrics.

Various theories have been put forward and discussed from time to time and mechanical models have been devised in order to explain the general behavior of textile materials when subjected to tension in this way. It is difficult, of course, to find a comprehensive theory to fit all the observed facts, since the various materials differ so much amongst themselves. Interesting though these are, they are very provocative of long discussion and can hardly be considered here.

Quantitative Tests

Quantitative tests, such as are regularly carried out in routine testing and analysis show that the elastic limits and breaking loads of nearly all rayons are definitely lower than those of the naturally occurring fibers. This fact is frequently expressed in the statement that the rayons have lower tenacities than the natural fibers, the tenacity being defined as the breaking load per unit denier. This affords a convenient way of comparing rayons, though its value is somewhat over-estimated since there are considerably more important characteristics of rayons than that of breaking load. However, this brings out the first important practical point. Since the artificial silks are weaker than the natural fibers, cloths made from them must be accorded gentler treatment in all operations.

It has been shown that the elastic limits of the rayons are low in comparison with those of the older textile materials. Great care must therefore be exercised in the use of rayon. Tensions which would do no harm to a wool cloth will permanently stretch an artificial silk fabric. The wool may be stretched by the tension, but its properties are such that while it rests in a relaxed state between the stages of a process the material returns to its original dimensions. The same, unfortunately, does not apply to rayon, for even if the tension applied has been less than that corresponding to the elastic limit, it does not follow that recovery will be anything like complete during relaxation, if the tension was maintained for any appreciable time.

In the deeper discussions of the load-extension diagram this important element of time has to be considered. Here a very important fact may be noted. A wool fiber may be stretched, by slowly increasing the load, to well over 20 per cent of its initial length and this tension may be maintained for hours. Yet on removal of the tension, contraction will at once set in and by repeated wetting with water the fiber may ultimately be brought back to its original length. Compare this with the stretching of rayon. It is well known that if this is loaded so that its extension exceeds about 3 per cent, then the material will never shrink to its original length, though a partial recovery may take place.

Thus, the initial portion of the rayon curve for dry material provides incontestable argument for the employment, during winding, warping, beaming, weaving and all other operations conducted on the dry material, of the absolutely minimum tensions necessary to secure the desired effects. For example, in beaming tension is necessary for several reasons and in weaving the tension on the warp beam must be sufficient to permit the insertion of the desired number of picks, but the lowest possible values of tension which will permit the attainment of these ends should never be exceeded. There is no doubt that much fabric is permanently stretched in this way before the dyer and finisher receives it. Thus it is clear that tensions found by long trial and experience to be both suitable and desirable for the older textile materials, may be much too great for the corresponding circumstances in the manufacture of rayon fabrics.

Released Strains

Despite the fact that there is some tendency, small it is true in comparison with that in naturally occurring fibers, for strains to be released and to disappear during relaxation or on wetting-out, yet it is possible for fabrics to be ruined by over-tensioning in the dry processes.

Though the dyer and finisher may find rayon fabric seriously damaged when he receives it, due to over-tensioning, he runs a far greater risk of doing damage than the dry process workers. Offenses against the laws governing the behavior of wet materials are of far greater import than against those concerning the dry state. It has been shown how tensions which may be applied without causing permanent extensions are considerably lower for materials in the wet state than they are for the dry state. Thus, it will readily be seen that unless the handling of rayon fabrics in the wet state is far gentler than for natural textile materials, permanent strains and extensions are unavoidable.

In dyeing on a jig, for example, every roller should be positively driven if possible, nothing, however well mounted, being left to be turned by the fabric. If extension does take place through too high a tension it is almost certain to be permanent, for the material goes from the batching roller to the take-up roller, and has no opportunity for recovery by relaxation, for its tension is never released.

Many instances have come to light of the extension in length of pieces of rayon fabric during dyeing and finishing amounting to as much as 6 to 8 per cent. It is not difficult, therefore, to see how the character of a cloth may be entirely altered, for the consequent change in the number of picks per inch is too obvious to pass unnoticed. Further, and perhaps this is even more important, an over-stretched cloth is bound to have a thin

and lean handle rather than a full one, and its draping qualities will be adversely affected.

Creasing Troubles

I have dealt with this matter so far entirely from the point of view of tension. It applies also, with modification, of course, to compression. Now, the chief respect in which compression concerns the dyer and finisher of rayon fabrics is that pressure on folds causes creases, and creases may be regarded as one of the nightmares of the finisher. In a crease the fabric is sharply bent over. If a filament crossing a crease is visualized, it will be realized that on the outer surface of the crease the material is much extended and that on the inner side it is much compressed. Calculations from the sizes of the filaments show that these elongations and compressions are much greater than is generally supposed. From the dyer's point of view their effect is almost too well known for mention of them to be necessary. The dyeing properties of the material at the creases are altered, and generally, in spite of all that can be done a sharp crease in grey fabric may be regarded as irremovable. Creases, however, must be the cause of much over-tensioning in the weft direction. The temptation to attempt to remove a crease by wetting and tentering is almost irresistible and yielding to it is perhaps pardonable to a certain extent.

One very serious result of over-tensioning, whether in the dry or the wet state, is the increase in the tendency for slipping to take place. This is perhaps one of the worst faults in rayon fabrics and is perhaps without exception the most troublesome. The finisher, in order to sell the fabric, is tempted to apply some anti-slipping treatment, knowing perfectly well that the first time the fabric is washed, its full tendency to slip will be restored. The fabric is bound to be unsatisfactory in wear and the sending out of such material can give little cause for satisfaction to the finisher.

The subject thus briefly sketched is really a very extensive one. It is quite impossible in the compass of a short article to pursue it in its many ramifications. Many aspects, it is admitted have not even been touched upon at all whilst others have received mere mention. The main object has been to show that a study of the fundamental properties of the various kinds of rayon and their comparison with those of the older fabrics in the light of the load-extension diagram will lead to a better appreciation of what is required in the treatment of rayon fabrics in dyeing and finishing. It will explain the reasons for the disconcerting results frequently obtained and will show in a general way the necessity for modification in plant, etc., and for departure from those methods which are based on long experience of the older textile materials.

*Dyer and Calico Printer.

Removal of Oil Stains from Indiana Limestone

(Continued from page 526)

dition was ascribed to the fact that the thorough cleansing had removed not only the oil, but all the natural impurities in the stone, and there remained, if we can so express it, only the pure skeleton work of the rock. Here, indeed, was a serious condition, and one which must be intelligently met if all the previous work done upon the wall was to be worthwhile.

An hypothesis, covering an analogous condition, was formulated by considering that if a piece of antique furniture was undergoing repairs, it would not be fair to criticize its condition, when the cabinet work was finished, but before the final staining, varnishing and polishing had been completed, and so it seemed perfectly logical that a finishing treatment could well be considered a part and parcel of the treatment required to restore the wall to its original condition. With this in mind, and after no oil had been drawn from the wall during a period of three days, a finishing treatment was given which changed the refraction of light on the wall, and it was with a distinct feeling of relief that we found the wall, when dry, assumed a soft, velvety, grey appearance, and all evidence of staining was completely obliterated. Yet, strange as it may seem, it was this very appearance, of which we were so proud, which cast doubt upon the whole accomplishment.

Several weeks, after the work had been completed, I was informed that one evening, a fire hose had been turned on the treated section of the wall. Had the water been turned on the whole building, no complaint would have been registered but under the circumstances, I wanted to ascertain the reason for such partiality and at the same time observe the effects of the washing treatment. It seems that the opinion had gained credence that the wall had eventually been treated with something to cover the oil, and that a thorough wash would again expose the stains, but even those who performed the washing conceded that the wall looked better after the wash than before.

This, in reality, was the exact state of affairs. Throughout the entire period when we had been constantly working to remove the stains, the rest of the wall was aging, absorbing street dust, smoke, etc., and becoming generally soiled, so that the final washing, given the treated section, only enhanced its cleaner condition.

Throughout the entire period, the several interested parties were extremely gracious, but the time finally came when the decision had to be made as to whether or not the finished wall was acceptable to all parties. Fear was expressed that the oil was not completely out and that the warm summer sun would draw more oil to the surface. What seemed to cause the most concern was that the final finishing treatment had been accomplished in about four hours, and had brought the entire surface of the wall to an absolutely uniform character, and such a marked change, in such a short period of time, could not be readily comprehended.

A year has elapsed since the work was completed, and no evidence is apparent that any oil is left in the stone to ever come to the surface.

The Weighting of Silk

(Continued from page 518)

of formic acid is the only organic tin salt which is suitable for weighting purposes. The silk is treated with a double salt formed from an alkali metal formate and tin tetrachloride (e.g., $Na_2Sn(HCO_2)_6.5H_2O$) or given alternate treatments with sodium formate and stannic chloride, and then washed in order to hydrolize the tin formate and deposit tin in the fiber.

The Foam Process

Before closing our survey of the historical development of processes for the weighting of silk, a few processes are of sufficient importance to warrant special mention. One unique contribution was the so-called "Foam Process" patented by Schmid and Gross in 1916. In connection with the phosphate and silicate baths there were used certain foam producing materials such as silkworm-chrysalises, silk wastes containing chrysalises, sericin, bone-dust, agar-agar or colophony. For example, to the usual phosphate solution there is added a bag containing 200 grams of silkworm-chrysalises for each 15 liters of solution. This phosphate solution covers the bottom of the vat and the silk skeins, previously treated with tin in the usual manner, are suspended above it. When heat is applied to this phosphate bath the foam rises and envelops the silk. Similar procedure is carried out with the silicate bath. It is claimed that one or two minutes in the foam bath is equivalent to 45 to 60 minutes actual immersion in the solution, thereby bringing about a saving in time and in the strength of the silk fibers. Although several installations were made in this country, the "foam process" has never come into very general commercial use.

Lead Weighting

The application of lead either alone or in combination with tin has commanded considerable interest from silk manufacturers largely because of the possibility of obtaining greatly increased weight by this means. After the usual succession of alternate treatments with tin and phosphate solutions, there may be one or more treatments with lead acetate followed by sodium phosphate. Or silk fabrics may be acidified with dilute acetic acid and then treated immediately with lead acetate followed by sodium phosphate, as described in a patent assigned to Berg and Imhoff. In all cases the silk must first be made acid with dilute acetic acid before immersion in the lead acetate solution. It is claimed that by this method a given quantity of silk may be increased to three or four times its original weight without serious injury to the fibers. However, there has been considerable agitation against this method of weighting because of the possibility of poisoning from contact with fabrics so weighted.

Single Bath Tin Weighting

Many of the more recent contributions to the literature on silk weighting have been furnished by René Clavel. In 1926 he patented a process for the tin weighting of silk in a single bath containing the interacting weighting reagents together with substances which retard precipitation. For example, the silk is immersed in a bath containing tin tetrachloride, formic acid, water glass, sodium phosphate and glue, and then transferred to a fixing bath containing ammonium carbonate. Various modifications of this original idea are suggested in subsequent patents. In every case the tin bath is made strongly acid with an acid such as formic acid (using a protective colloid if desired) or else the silk is treated in the acid bath before entering the tin. The salts such as phosphates or silicates may be incorporated in the tin bath or the silk may be transferred from the tin bath to the phosphate bath with or without washing between these baths. If a silk fabric is carried directly from an acid tin bath to an alkaline phosphate bath without an intermediate washing, a mat surface is produced. However, if the phosphate fixing bath is made acid with hydrochloric or some other suitable acid, the natural luster of the silk will be maintained. Centrifuging or squeezing may be used instead of washing between the tin bath and the fixing bath if so desired.

Clavel has also patented a process for weighting by means of a printing paste. The usual solution of tin tetrachloride is thickened by means of such substances as gum arabic, dextrin or starch, and the paste is either padded or printed in a pattern on one or both faces of the silk. Phosphates or silicates may be added to this printing paste or the silk may be treated in a bath containing sodium acid phosphate subsequent to the printing.

Weighting Silk in the Gum

Before leaving this historical summary of the various processes proposed for the weighting of silk, it is of interest to touch upon the question of weighting silk in the gum. In a method sponsored by Eugene L. Maupai this is accomplished by first treating the gum silk in a dilute solution of chromium chloride, ferrous nitrite or alum in order to harden the gum. After this pretreatment the gum silk can be weighted by means of the usual alternating baths of tin, phosphate and silicate. It may subsequently be degummed whenever it is so desired.

Another method for the weighting of silk in the gum has been patented by Charles P. Cole. He makes use of a boiling solution of cream of tartar or some other magnesium salt to fix the gum on the silk prior to the weighting operation. A typical example of the operations included in this method is given below:

1. Preparatory bath containing a lukewarm solution of soap, sodium carbonate and ammonia.
2. Two rinses.
3. Bath containing dilute hydrochloric acid.
4. Extract.
5. Soupling bath of boiling cream of tartar.
6. Rinse and acidulate with hydrochloric acid.

7. Alternating baths of tin, phosphate and hydrochloric acid. Repeat up to five times as desired.
8. Dilute sodium carbonate bath.
9. Sodium silicate bath.
10. Three rinses and finish in the usual way.

In recent years there has been a steady decrease in the amount of silk which is weighted in the skein form. The development of modern equipment and methods of handling have greatly improved the quality of silks weighted in the piece so that very satisfactory results are obtained by this method at the present time. The weighting of silk after weaving offers the advantage of greater speed of production with a corresponding decrease in the cost, and it also eliminates the necessity of carrying such a large inventory of weighted silk. Consequently weighting in the piece has almost entirely supplanted the earlier weighting in the skein. The methods and apparatus which have been developed for the weighting of silk piece goods will be discussed in the next chapter under the heading or present-day weighting procedure.

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(Continued on page 543)

Handling Dyehouse Liquors

(Continued from page 522)

dyeing processes lead to the formation of insoluble soaps, which are deposited on the fiber and give rise to endless trouble. Such soaps are very difficult to remove and sometimes end in the spoiling of a batch, making leveling of the colors an impossibility.

Among the most popular forms of softeners is the zeolite type in which a mineral, natural or artificial, is used to exchange the calcium and magnesium salts for innocuous soda salts. The mere passage of the water through the bed in the plant is enough to effect the exchange, but there comes a time when the zeolite can do no more and requires regeneration, which is brought about by soaking for a definite time in a strong solution of common salt. Such, briefly, is the outline of the operation of this very reliable form of water softener which calls for practically no maintenance charges beyond the cost of the salt that is applied once every twenty-four hours, and the wages of an attendant whose duty it is to test the hardness of the water at stated intervals during the run. This duty is of great importance and should be in the hands only of a thoroughly reliable person. There is, however, one matter in regard to the softening plant which should received close attention; this is its capacity. It might be thought at a first glance that if a softener can deal with a quantity of water equaling the demand of the dyehouse during the same period that it will be large enough, but this is not necessarily true because in every busy mill there are rush hours when everybody seems to be wanting abnormal quantities of water for filling up becks, for washing batches, and so on. If this happens, as it very frequently does, towards the end of the run when the zeolite is showing signs of wanting regeneration, the water will come through unsoftened. The importance of having a greater capacity for softening than is apparently required is very obvious; even if the dyehouse does not take all the water, the surplus can always go to the boilers where it will be a benefit in the way of reducing the quantity of sludge. If the question of economy is raised when a softener is being installed, it should always be borne in mind that much more money will need to be spent when it becomes necessary to put in a second plant to supplement the first to cope with the natural increase of business.

Sometimes the softened water passes right from the plant to the dyehouse; by "dyehouse" is meant all the departments in the finishing that need soft water. In other places there is a storage tank from which to draw as required. This may be advantageous in the majority of cases always provided that due care is exercised in keeping the tank clean and free from bacterial growths. Some of these accumulate iron which is carried down the pipes and deposited on the fabrics in the form of flocculent iron oxide giving rise to brown specks all over the cloth. These become embedded in the fibers and are very hard to get out. A temporary check is to tie a small muslin bag over each faucet, but the tank should be kept clean. To get the water into the tank a pump will be required which should be simple to drive and easy to repair. Moreover, it is necessary to see that a stock of spare parts are in the store, because a delay in the regular supply of water in the dyehouse is apt to have very serious consequences. Here again, it should be pointed out that such delay or damage is not the fault of the dyer who, far too often gets the blame for it. If the cost of the damage is charged against the maintenance department and the responsible official is carpeted over the head of it, such delinquencies will very soon stop.

There are some mills so happily situated that the disposal and general handling of the waste liquors arising in the bleachery and dyehouse present no difficulties; on the other hand there are locations in which the textile manufacturer finds himself hedged around by a cactus fence of regulations that make life little short of burdensome when he does anything wrong. When there is main drainage with outfall to the sea or to an extensive sewage farm, there is not apt to be much trouble unless the authorities object to the evolution of chlorine every now and then, but when the flow is into a river or lake, the fishing rights and other amenities of the district may suffer, and when once they begin to talk they keep on at it with relentless monotony until their grievances are checked. The poet sang about "Hell hath no fury like a woman scorned," but he had never met a fisherman who had seen his prey float past belly up through the effluent from a dyeworks.

The waste liquors contain bleaches, acids, soap and colors; when these all flow together they may be said to neutralize each to a great extent and result in a comparatively harmless sludge, but it may be necessary to put in a catchment basin to make certain that this does take place; the contents of the basin would require testing before it was permitted to escape. Another simple method of stopping much of the trouble is to put a bed of chalk or limestone, supported on a layer of coke, in the outflow channel. This has the effect of killing the acid and holding up the soap and colors, and has been found quite satisfactory in a number of cases. Here, too, it is advisable to have a duplicate channel to avoid a check when it becomes needful to replenish the bed or wash off the accumulated mud. The wastage of dyestuffs will be dealt with more fully later.

The recovery of wastes from dyehouse and other liquors has often been the subject of research, and many ingenious plans have been suggested for dealing with the

matter but there are at least two good reasons why they have not been adopted by the majority of mills, even when rationalization has been introduced in other respects. One is that it usually requires a series of large tanks and a specially arranged drainage system; the other is the cost of recovery. It is not proposed to discuss here all the plans that have been brought forward from time to time; it will suffice to mention two, in connection with soap, which is, perhaps, the largest item in the waste bill taken over the textile industry as whole. It may be that soda is wasted to a greater extent but for the present purpose we will consider soap. One plan for saving it is to precipitate it in the form of insoluble calcium soap by adding a solution of calcium chloride to the waste liquors. The calcium compound has some market value as an ingredient of lubricating greases, but it has been found in practice that by the time the recovered grease has been collected, dried and purified, the cost is far above that of freshly made calcium soap composed of comparatively pure materials. It would, therefore, only be possible in large concerns that have the means of handling such sidelines on a profitable commercial basis. Another plan is to use the waste acid for cracking out the fatty acids from the soap, collecting this and boiling with soda to make fresh soap. If both the raw materials are derived from wastes the cost of collection and evaporation of the soda from solution and then causticizing it is prohibitive, while if new soda is used it will probably be cheaper to buy fresh soap. Apart from cost, the technical details of ensuring that only the correct wastes are allowed to run down certain drains would be very troublesome in most cases.

By far the best method of conserving wastes is to cut down the quantities used in the first place to bare limits; if 100 pounds of soap, say, is the usual charge for a certain operation, would not 95 pounds or even 90 pounds answer the purpose equally well? It probably would, and a saving of 5 or 10 per cent would make a difference at both ends of the line. So it is with the majority of the chemicals used; there is far too great a tendency to use too much so as to be on the safe side just because a material happens to be bought by the hundred ton instead of by the pound. The operatives who think only of the wasting of a few cents on a single bath have no conception of the ultimate annual saving on thousands of such baths that will result from a slight economy in working.

In the case of dyestuffs, the total saving that can be effected is very large. The dry powder or paste in the dyestores has a distinct commercial value; the annual loss down the drains even though it may be but a few grams at a time runs into large figures and none of it can be recovered. The use of standing baths, and the cutting down of the quantity used are the best methods of saving this sort of waste; if dye is wasted its value should be estimated, generously, and charged against the offender, while a bonus to the operator who reduces the amount used over a definite period should be a fine incentive to economy. This goes equally well for the chemicals used for bleaching and elsewhere.

An important fluid, if not exactly a liquid, that requires handling in the textile mill, is steam. Under ordinary circumstances, all that is done with it is to convey it by means of a pipeline, suitably lagged, from the boiler in which it is generated to the beck in which it is to be used. One has seen the lagging on steam pipes neglected, broken away and missing altogether, although the coal loss on bare piping may be taken as being roughly equal to one-half ton per annum for each square foot of bare pipe surface; a good lagging will save at least two-thirds of this. It may be expressed in another way: in 152 feet of bare 2-inch pipe there is a loss of one horsepower, but if a good lagging is used, the run is increased to 800 feet. There can be no doubt that it will pay to look around the mill and correct any mistakes in the matter of covering the steam pipes. Opinions differ as what is the best coating that can be applied to pipes; there are quite a few good proprietory laggings that can be obtained on the market. Some of these are better than others; it is up to the makers to prove which is the best. Many mill owners still pin their faith to the old fashioned "monkey" material which is composed of something like slagwool, cowhair and wet clay and is daubed on to the hot pipe, being afterwards smoothed off, covered with burlaps and tarred. It certainly takes a lot of beating from every point of view: efficiency, cost, durability, and ease of application.

Many textile mills waste too much steam of which could be saved or at least checked by taking suitable measures; there are uses to which many of the small quantities of steam that are at present seeping into the drains can be put. If collected into one place they will supply hot water which can be pumped into becks and save on the heating for dyeing. Actually, the scientific handling of steam will lead to considerable economy, and while this is generally recognized, how great that saving may be is not always so fully realized. The problems of every mill differ from those of the next and it would be impossible to give any directly useful information that would cover all cases; the best plan is to call in experts in this class of work and let them suggest the means whereby all the steam that is produced may be utilized to the best advantage and with a minimum of waste. The idea is to combine power and heating by the installation of a turbine or some such engine that will give the necessary power, leaving the exhaust steam free for the purposes of heating the dyekettles.

If it is accepted that the theoretical amount of heat needed to produce steam at 200 pounds pressure is only 2.7 per cent greater per pound of steam than at 30 pounds pressure, even when due allowances are made for practical losses, it is evident that only a slight increase in the amount of fuel will raise steam to a pressure high enough to drive a turbine, productive of useful power, and in doing so, will be sufficiently reduced for use in heating up the dye liquors. By some such alteration and addition to the plant it is claimed that a thermal efficiency of between 50 and 60 per cent can be produced instead of the

20 per cent that is more usually found in the steam plant of textile mills. Such installations of power-heating engines are of widespread popularity and the value as waste preventers appears to be unanimously acknowledged. One case brought to the writer's notice showed this saving very well: a simple non-condensing turbo-generator was installed in the mill at a cost of $10,000 to extract power from process steam. In the first eight months the saving was $4,080, say, $6,000 a year. The plants thus paid for itself in the course of twenty months, or a little over when allowance is made for depreciation and interest on capital involved. A further point to be considered is that actually 7 per cent less oil fuel was burned for combined power and heating than had been used previously for heating alone.

It is, of course, a fact well known though apparently not yet satisfactorily explained, that exhaust steam has greater heating power than live steam, which is a point that many mill owners do not appear to be aware of, although there are a number of good authorities who will state with confidence that the exhaust steam from engines will dye fabrics more quickly than steam from boilers at equivalent pressure. The report from another mill tells that no live steam is now used for dyeing, only exhaust steam. The power supply from outside source formerly cost around $600 a year; this is all generated inside now by working the engine at nearly double the former load but, notwithstanding that, a four months' trial showed the coal consumption to be slightly less than it was before. A woolen mill reduced its coal bill in this way from 80 tons a week to between 57 and 65 tons; another effected savings running between $50,000 and $60,000 a year by similar means.

There can be no doubt that at a time when economy is needed one of the places where it can be effected is in the use of steam. In any well conducted mill or textile factory of any kind, the greater number of processes are carried out with due regard to expenditure; it is necessary therefore to look around to see where further economies, often not very great in themselves, can be brought about. The cumulative effect of these will soon be noticed and may easily be enough to remove the red ink from the balance sheet entirely.

New Scouring Agent

General Dyestuff Corporation offers as a new scouring agent, Igepon A, of I. G. manufacture. This novel and extremely interesting product is a representative of a new class of substances which, although chemically different from soap, is said to possess the same valuable washing and cleansing properties.

Igepon A is of neutral reaction and may be used in a neutral bath. Whereas soap solutions are always alkaline, it is claimed that there is less danger of the color or of the wool fiber being affected if this product is used.

The company claims that Igepon A is stable and keeps its cleansing properties even in an acid solution.

The Weighting of Silk

(Continued from page 540)

German Patents

106,958, Nov. 11, 1899. Casein or gelatine with formaldehyde.
179,498, Dec. 11, 1906. Stannic chloride with sodium bisulfite, neutralized with ammonia.
214,372, Oct. 11, 1909. Stannic chloride with zinc sulfate followed by tartaric acid and sodium phosphate.
215,702, Nov. 5, 1909. Modification of G. P. 214,372.
261,142, June 13, 1913. Salts of tin fixed with phospho-tungstic acid.
276,423, July 8, 1914. Zirconium sulfate tetrahydrate.
277,431, Aug. 10, 1914. Modification of the usual phosphate fixing bath.
281,571, Jan. 26, 1915. Mixtures of salts of rare earth metals.
282,251, Feb. 19, 1915. Organic salts of zinc, zirconium or titanium fixed with steam.
298,235, June 8, 1917. Chromium fluoride followed by phosphate.
312,301, Jan. 14, 1922. Hydrogel of zirconium hydroxide.
316,754, Dec. 1, 1919. Regular tin weighting followed by logwood and gum soap.
319,112, Feb. 18, 1920. Recovery of weighting salts.
319,113, Mar. 11, 1920. Modification of G. P. 319,112.
382,606, Oct. 4, 1923. Treating gum silk with tin salts and fixing with ammonia gas.
382,646, Oct. 4, 1923. Lanthanum nitrate fixed with ammonia gas.
389,813, Feb. 8, 1924. Sodium formate followed by stannic chloride.
392,279, Mar. 18, 1924. Tin, phosphate, logwood.
468,017, Sept. 18, 1926. Same as B. P. 303,128.
468,018, Sept. 18, 1926. Same as B. P. 303,129.
481,659, Nov. 20, 1927. Same as B. P. 300,894.
503,971, Nov. 29, 1927. Same as U. S. P. 1,749,699.

(To be Continued)

Useful and Undesirable Mixtures of Dyes

(Continued from page 528)

2. The delivery of the dyestuff with a large content of moisture.

3. The wetting of the base color to be shaded or brightened with a convenient solution of the color or colors to be used for the purpose.

4. The addition of the shading or brightening color or colors in the form of solutions of convenient strength to the solutions of the base dyestuffs before these are salted out for the last time.

Some color works obtain more stable dyestuffs by only mixing powders having the granules of exactly the same size, that are controlled by passing the powders through mechanical sieves of perfected construction. These require in many cases products in the very finest subdivided condition, and quite dry as they are more easy to mix. When it is not possible to reach the above conditions with the products at disposal, a mixture is prepared in the usual way and submitted to grinding. If the dyestuffs have been chosen with their molecules of about the same weight, or of little different weight, the above arrangement is a marked advantage. In the contrary case heavier particles will still have the tendency to descend in the dyestuff mixtures.

Some producers, to avoid the above inconvenience, deliver their mixtures of dyes in a slightly wet condition, facilitating this by incorporating small quantities of prod-

ucts that absorb moisture from the air. The small particles of the added products better adhere, in this way, with the particles of the base dyestuffs, and there is less danger that those of heavier weight should descend during delivery or storage. The arrangement brings unfortunately several inconveniences, such as:

1. A slight dilution in the strength of the products offered, that has to be compensated by the use of a little more of the base and mixture colors.

2. The absorption of an excess of moisture in the dyehouse, causing too much sticking together of the different particles of dyestuff, and more difficult separation during the withdrawals for the dyeing operations.

3. A difference in the weights of dyestuff taken when the kegs have just been opened, and when their contents have been half used up.

The process, where the base color powder is wetted with solutions of the shading or addition colors of the most convenient strength can be of advantage when conducted with appropriate means, which distribute the latter in the form of many very fine sprays together with air heated to a certain temperature in the interior of the mixing drums, while the powdered base color is being continually mixed. In this way a uniform shading of the granules in the base dyestuff powder is accomplished, that is soon dried by the hot air passing through. The hot air current is shut off after a comparatively short time of treatment. With the necessary precautions, a dyestuff mixture is thus obtained composed of only one size and kind of granules, on which a very minute portion of the solution of the addition colors is deposited, and whenever the dyer takes a small or large quantity of the resulting product for his coloring operations in the works, he runs no danger of surprises, admitting, of course, that no extraneous matter is allowed to make its way in the kegs.

The process of adding the shading color to the solution of the base color before its final salting-out, would represent the cheapest and surest way for forming mixtures of colors. The most suitable products would however be necessary for the purpose if the best results are wished and the value of the base colors is not to be reduced in any way. The resulting mixture, when transformed into powder, only contains one lot of granules, and even if the latter change place continually, no harm can follow. Besides this, the dyestuffs offered on the market can be distinguished only with difficulty from the pure products, this being possible only through very exact comparative trials conducted by dyeing and by other special methods.

In a new card "Substantive Dyestuffs Levelling Best On Viscose Which Shows Bar Effects" brought out by the General Dyestuff Corporation, a selected line of Direct and Developed colors is shown, which produce level dyeings on viscose piece goods, which are liable to show Bar Effects. I. G.-334.

NEW PATENTS

Azo Dyes Derived from 2.3-Hydroxy-Naphthoic Acid Arylamides. (Possess remarkable fastness properties especially to light and dye cotton clear shades similar to those of alizarine red.) Eugen Glietenberg, of Leverkusen-on-the-Rhine, Josef Haller, of Wiesdorf-on-the-Rhine, and Max Baltes, of Leverkusen-on-the-Rhine, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,813,618, July 7, 1931.

Cyanogen Halide Derivatives of Cellulose and Process of Making. (Comprises reacting upon alkali cellulose with cyanogen bromide in the presence of carbon-tetrachloride. Products thus obtainable behave very similarly to cellulose, but in contradistinction to the latter show a nitrogen content and have the property of being directly colored by acid wool dyestuffs in strong shades.) Josef Haller, of Wiesdorf, Ger., assignor to I. G. Farbenindustrie Aktiengesellschaft, of Frankfort-on-the-Main, Ger., No. 1,813,619, July 7, 1931.

Process for Changing the Solubility of Cellulose Acetate. (Relates to a process for the hydrolysis of cellulose esters, and particularly the hydrolysis of chloroform soluble cellulose acetate to acetone solubility.) Cyril J. Staud and Charles S. Webber of Rochester, N. Y., assignors to Eastman Kodak Co., of Rochester, N. Y., No. 1,813,685, July 7, 1931.

Dyestuffs Containing Chromium and Process of Making. (Obtainable by treating the azo dyestuff obtainable from the nitrated diazo compound of 1-amino-2-naphthol-4-sulfonic acid and B-naphthol, with a salt of trivalent chromium in the presence of a water soluble salt of a strong mineral acid and a metal other than those which form metal compounds with the dyestuff, which chromium compound dyes wool black shades of excellent fastness.) Hans Kammerer, of Mannheim, Ger., assignor to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,813,879, July 7, 1931.

Process for the Preparation of 4-Halogen-Beta-Phenyl-Anthraquinone. (Dyestuff intermediate, which comprises heating 4-halogen-para-phenyl-ortho-benzoyl-benzoic acid with sulfuric acid monohydrate as a dehydrating agent.) Philip H. Groggins, of Washington, D. C., dedicated, by assignment, to the Government and the People of the U. S. A., No. 1,814,146, July 14, 1931.

Process for the Preparation of 2-Halogen-Beta-Phenyl-Anthraquinone. (Dyestuff intermediate, which comprises heating the aluminum base of 2-halogen-para-phenyl-ortho-benzoyl-benzoic acid with nitrobenzene.) Philip H. Groggins, of Washington, D. C.; dedicated, by assignment, to the Government and the People of the U. S. A., No. 1,814,147, July 14, 1931.

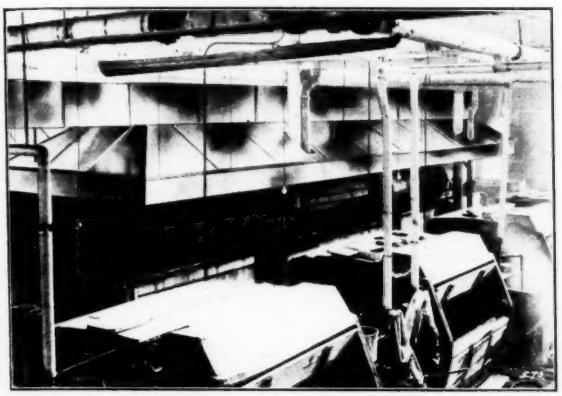
Process for the Preparation of 4-Amino-Beta-Phenyl-Anthraquinone by Ring Closure. (Dyestuff intermediate, which comprises heating 4-amino-para-phenyl-ortho-benzoyl-benzoic acid with sulfuric acid as a dehydrating agent.) Philip H. Groggins, of Washington, D. C., No. 1,814,148, July 14, 1931.

NEW EQUIPMENT

Defeating Corrosion in Dye House Fume Ducts

The problem of providing suitable ventilation to carry fumes from dye tanks and at the same time defeating the corrosive action of the fumes on the equipment has been solved by the Wiesner-Rapp Company, sheet metal experts of Buffalo, for a large textile plant in the vicinity of that city.

The equipment consists of a hood, ten feet long, with a tapering duct mounted upon it to conduct the fumes to the fan. Ports, six inches by twenty-four inches, in the top of the hood admits the fumes to the duct. Any condensate is conducted to a trough running around the apron of the hood and discharged to the sewer through a pipe at the fan end.



Defeat of corrosion is effected through the use of No. 20 gauge monel metal sheet for both the hood and the duct. Both are of standing seam construction, riveted with monel metal rivets and braced with monel metal bar stock.

The first unit of this equipment was installed more than a year ago but at no place is there any sign of corrosion. The inside and the outside of the hood still has the appearanse of new full finished sheet except around the outside of the trough where there is a slight surface discoloration. This may easily be rubbed off with the fingers and there is no sign of corrosion.

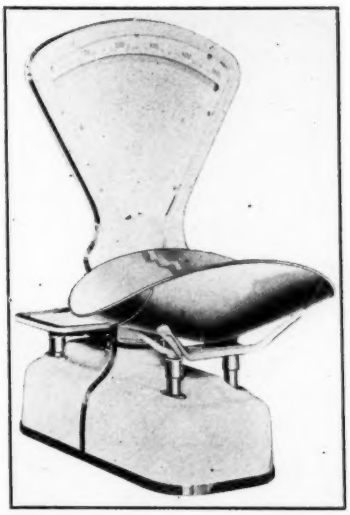
Laboratory Scale

A laboratory scale, designed to permit close reading without the use of extended beam equipment, has recently been perfected by the Toledo Scale Company, Toledo, Ohio.

The chart on this scale has a capacity of 500 grams, with a mark and figure for each gram. It also shows the avoirdupois equivalents. Additional capacity up to 5 kilograms may be secured by the use of weights.

This scale is so designed that the oscillation ordinarily found in extended beam type scales is said to be eliminated.

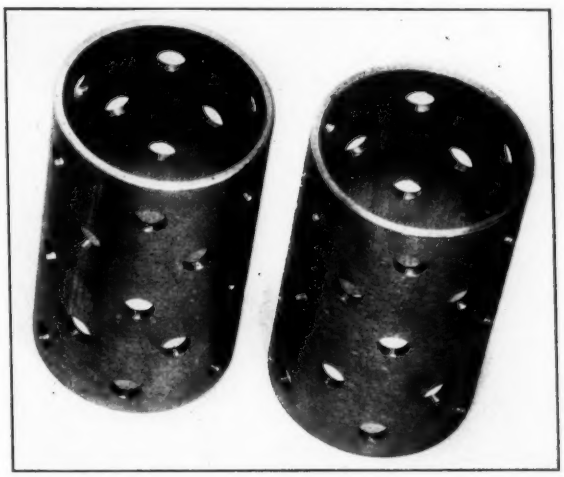
The chart housing may be set at any convenient angle, and the scale comes equipped with either a pan, platter or scoop as the purchaser desires. It is finished in grey baked enamel which is easily kept free from dust and dirt.



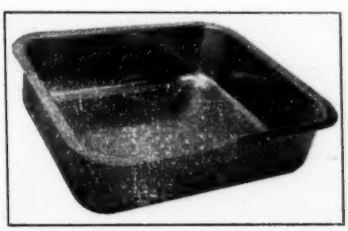
This scale is for use, primarily, in industrial research laboratories. The manufacturers claim it will be a great aid to research engineers as it enables them to weigh ingredients accurately, to the gram, in approximately one-quarter the time consumed with balance equipment.

Further information may be obtained by writing the Toledo Scale Company, Toledo, Ohio.

Perforated Pure Nickel Tubes Used on Franklin Process Machines



The illustration shows 1¾" diameter by 3" long x .083" wall perforated pure nickel tubes as used on Franklin process dyeing machines. These are manufactured by the Johnson Machine Works of Northville, New York.



For the Dyehouse Laboratory

The new seamless monel metal sink bowl is said to be an ideal item for installation in the modern laboratory.

Any sheet metal worker can install it as a sink with monel metal table top and splash board. Other mills find it makes an ideal laboratory water bath as its seamless construction makes it leak-proof under the action of hot calcium chloride solutions used for this purpose. These bowls may be obtained from any monel metal distributor. The dimensions are 18" x 24" x 6½" and they are drawn from 16 gauge monel metal sheet. The bowls are polished on the inside.

Dyeing Silk Shoes

Various methods may be used in the dyeing of silk shoes. Dyeing with direct dyes by the cold method requires great skill and experience, otherwise the shoe may lose its shape, thus rendering it useless. It is easier to dye with basic dyes, which may be dissolved in gasoline or alcohol.

Spray dyeing is the best method, for which various basic dyestuffs such as Brilliant Green, Thioflavine, Rhodamine, Victoria Blue, Safranine and Bismarck Brown may be applied. The dye may be prepared as follows:

For 1 kilogram of spray dye preparation, up to 50 grams of dyestuffs may be used, dissolved in 450 grams of hot water, to which add 20 grams of glycerine, and 150 grams of acetic acid. This solution should be brought to a boil with 250 grams of Tragacanth slime and 50 grams of British gum. After cooling, a little tartaric acid, tannin and acetic acid should be added.

Leather shoes may be dyed either by spray or by brush. —*Deutsche Faerber Zeitung.*

Definit Italian Dye Factory Reorganized

According to Trade Commissioner Elizabeth Humes, Rome, at a recent board meeting of the Montecatini, the report was confirmed that a new company has been formed, which will go under the name of "A. C. N. A.," but while the old "A. C. N. A." stood for "Aziende Chimica Nazionale Associate," the dyestuffs and explosive subsidiary of the former Italgas group, these letters now denote the new company, "Aziende Colori Nazionali Affini." The new A. C. N. A. will be capitalized at 60 million lire, held jointly by the Montecatini and the I. G. Farbenindustrie group. The new company will continue to operate the former A. C. N. A. plants at Rho, Ceasno Maderno and Cehgio. A new company, known as the Societa Chimica Nazionale, has been formed to operate the plants at Bussi, in which various products connected with national defense are to be developed. For this reason the stock of the Societa Chimica Nationale is entirely in the hands of the Montecatini and the operations in this section will be tied up with the experiments on new products which are being carried out by the Societa Dinamite Nobel of the Montecatini group.

Removing Dye from the Hands

Workmen in the dyehouse usually clean their hands with chloride of lime. This method is very unpleasant as the odor lasts for hours and the irritating action is injurious to the skin especially in the case of sample dyers, who have to clean their hands more often and more thoroughly. In cold weather the severely chapped hands have a very bad effect upon the general physical condition of the worker. The irritation of the hands unfortunately cannot be relieved by lotions or by any other method.

It has been found that the hands may be well cleaned without contacting them with chlorine and the following method has gained ground more and more. The hands are first washed with green soap and warm water, rinsed and thoroughly rubbed with potassium permanganate. After a good rubbing the brown discoloration is removed by washing in a sodium hydrosulfite solution. Any brown by washing in a sodium hydrosulfite solution.—*Deutsche Faerber Zeitung.*

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

MASTER DYER

Thoroughly experienced in cotton, worsted, silk and rayons. Skeins, warps, packages, pieces, ribbons, hosiery, etc., on every type of machine. Philadelphia or vicinity desired. Box No. 683, American Dyestuff Reporter, 440 Fourth Avenue, New York, N. Y.

DUE TO CURTAILMENT IN INDUSTRY

Textile Chemist and Colorist available for production or sales. Details and references will be furnished on request. Address Box No. 686, American Dyestuff Reporter, 440 Fourth Avenue, New York, N. Y.

POSITIONS WANTED

Hosiery dyer and assistant dyer employed at present desire connection with high grade mill or dyehouse. Capacity and location no objectives. Ready to take immediate charge. Both technically trained. Excellent references. G. H., 105 East 8th Street, Brooklyn, N. Y.

ASST. HOSIERY & RAYON DYER

20, single, desires to make a change. Can prove worth to a company recognizing initiative and effort. Three years of practical experience in hosiery and rayon dyeing and laboratory work. References. Full information on request. Address Box 687, American Dyestuff Reporter, 440 Fourth Avenue, New York, N. Y.